DOCUMENT RESUME

ED 245 889 SE 044 622

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TITLE	Energy and Economics for the Middle Grades. Unit II. Lessons and Activities for the Middle Grades.
INSTITUTION	Indiana State Dept. of Commerce, Indianapolis. Div. of Energy Policy.; Indiana State Dept. of Public Instruction, Indianapolis. Div. of Curriculum.
SPONS AGENCY	Department of Energy, Washington, D.C.
PUB DATE	May 84
GRANT	DE-FG45-76CS60038
NOTE	158p.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	Conservation Education; Costs; *Decision Making; *Economics; *Energy; Energy Conservation; Intermediate Grades; Junior High Schools; *Learning Activities; Lesson Plans; Natural Resources; *Resource Materials; Teaching Methods
IDENTIFIERS	Alternative Energy Sources; *Energy Education; *Supply and Demand

ABSTRACT

Working knowledge of basic economics concepts can assist in developing the necessary understanding and decision-making skills inherent in dealing with changing energy situations. The eight basic and four advanced lessons included in this guide have been designed to help students in becoming more aware of the energy choices that they must make in the present and for the future. The energy and economic concepts contained in these lessons can help students in making these choices. Each lesson includes concept(s) to be fostered, recommended time, list of materials needed, economics concepts in the lesson, rationale for the lesson, instructional objectives, suggested instructional strategies, suggested evaluation strategy, and student materials (such as handouts and worksheets). A list of free and inexpensive resources in energy economics (arranged by such subject areas as coal, conservation, electricity, and environment) is also provided. Topic areas addressed in the basic lessons include: energy consumption; current energy sources; energy alternatives; productive resources (labor, capital, natural resources); opportunity costs; and supply and demand. Topic areas of the advanced lessons are changes in supply and demand, internal and external costs, responding to changes in price, and price ceilings. (JN)

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for the Middle Grades

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ENERGY AND ECONOMICS

UNIT II

LESSONS AND ACTIVITIES FOR THE MIDDLE GRADES

Division of Energy Policy
Indiana Department of Commerce
Lt. Governor John Mutz, Director

Division of Curriculum
Indiana Department of Education
Harold H. Negley, Superintendent

May 1984

ACKNOWLEDGMENTS

The Energy Education Curriculum Project was coordinated by the Indiana Department of Public Instruction, Division of Curriculum with the support and assistance of the Indiana Department of Commerce, Division of Energy Policy, Clarence Broadus, Director.

These materials were authored by Dr. Alan Backler and were developed at the Social Studies Development Center, Indiana University, Bloomington. Indiana DPI energy consultants and Bonnie Mikkelson, Teacher Associate, coordinated the development and dissemination.

Members of the Energy and Economics Steering Committee worked closely with the developer of the materials. Also providing valuable assistance throughout the project were DPI consumer and economic education consultants; Dr. Devon Yoho, Ball State University; Charles Coffee, Governor's Energy Conservation Advisor; and Dr. Peter Harrington, director of the Indiana Council for Economic Education.

Dr. Peter Harrington assisted with the review process which was completed by teachers who participated in the Economics of Energy Workshops. These materials have been revised based upon the comments and suggestions of the teachers.

This material was prepared with the support of the U.S. Department of Energy (DOE) Grant Number DE-FG45-76CS60038. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the authors and do not necessarily reflect the views of DOE.

CREDITS

Many of the lessons included in this unit were adapted from existing national energy education programs. The materials were adapted with permission from the following:

Energy Trade Offs in the Marketplace
Washington State Council on Economic Education
Office of the Superintendent of Public Instruction
Olympia, Washington 98504

The Energy 80 Resource Book, Volume 3, "Teaching About Energy", Unit 7; (c) 1982 Enterprise for Education, Inc. (Permission granted to individual teachers to reproduce the student handouts "Using the Factors of Production to Get Energy", Lesson 3, and "Other Uses for Resources that Could Be Used to Get Energy" Lesson 5.)

Enterprise for Education, Inc.
1320 A Santa Monica Mall
Suite 205
Santa Monica, CA 90401

Energy Curriculum for the Primary Grades
Pennsylvania Department of Education
333 Market Street, P.O. Box 911
Harrisburg, PA 17108

Using Economics in Social Studies Methods Courses - (c) 1982, Joint Council on Economic Education. Materials may be reproduced for classroom use in the State of Indiana (Lessons 6 and 7).

Joint Council on Economic Education
1212 Avenue of the Americas
New York, NY 10036

Energy Graphics
World Eagle
64 Washburn Avenue
Wellesby, MA 02181

1981 Annual Report to Congress (Graphics)
Department of Energy
Washington, D.C. 20585

The "Glossary" and "Free and Inexpensive Resources for Energy and Economics" were adapted and reprinted by permission of the publishers respectively from:

Economics: Meeting People's Needs
George F. Watson, Jr. et.al. (c) 1979.

Science Research Associates, Inc.
155 North Wacker Drive
Chicago, IL 60606

Looking for Energy? A Guide to Information Resources

American Petroleum Institute
2101 L Street, Northwest
Washington, D.C. 20037

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INTRODUCTION

Energy education is the attempt to resolve the conflict between our present life style and the energy costs in both dollars and resources to produce and maintain that life style.

Working knowledge of basic economics concepts can assist in developing the necessary understanding and decision-making skills inherent in dealing with the changing energy situations.

These lessons have been designed to help students in becoming more aware of the energy choices that they must make in the present and for the future. The costs of maintaining a specific standard of living and a thriving national economy can be controlled with wise energy choices and decisions. The energy and economic concepts contained in these lessons can help students in making those choices.

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LESSON 1: QUESTIONS ABOUT ENERGY CONSUMPTION

CONCEPT: Consumption

RECOMMENDED USE: Middle school

TIME REQUIRED: 1-2 class periods

MATERIALS REQUIRED: Transparency: "U.S. Energy Consumption Per Capita, 1950-1982"
Transparency: "Breakdown of U.S. Energy Consumption"
Blackline masters are provided.

ECONOMICS IN THIS LESSON:

Satisfying people's wants for goods (products) and services is the main purpose of economic activity. The process of satisfying wants is called consumption. People consume (use) goods and services to satisfy their economic wants.

RATIONALE:

As background for understanding the current energy situation it is important for students to understand that energy is a product that people consume to meet certain needs. In this lesson two basic questions about energy consumption in this country are considered.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. recall some basic facts about energy consumption in the U.S.
2. identify major energy uses in the U.S.

SUGGESTED TEACHING PROCEDURE:

A. Begin the lesson by putting the number "306,000,000 BTU's" on the chalkboard. Have students spend a few minutes guessing what this figure represents.

B. Then ask "Would it help if I told you this figure is equivalent to 2448 gallons of gasoline?" Allow for some more guessing.

C. If they haven't already guessed tell students that the number represents the approximate amount of energy consumed by every man, woman and child in the U.S. (Actually the figure is for 1982). To make the per capita energy consumption figure more meaningful to students, have them calculate how long 2448 gallons of gasoline would keep a car running, assuming it used 20 gallons a week.

D. Project the transparency "Energy Consumption Per Capita, 1950-1982." Have students determine what the graph is about by:

1. inspecting the graph title
2. checking the graph source, and
3. examining the information on the graph.

They should respond something like: It is a line graph based on information from the U.S. Energy Information Administration, about energy consumption in the U.S. The information is for 1960-1982 and is given per capita. Energy information is given in millions of BTU's per capita.

E. Then ask students to discover the trend in energy consumption that is shown on the graph. Has consumption per capita increased between 1950 and 1982? Was it a slow, steady increase or did it increase by jumps? The students should respond that consumption per capita did increase during the period 1950-1979. A big jump occurred between 1965 and 1970. Since 1979, consumption per capita has decreased.

F. Say that the class has seen how much energy is used or consumed in the United States in a year. Then say something like "Now let's brainstorm about how energy is used in this country. Name as many different uses for energy as you can."

NOTE: Write the Rules for Brainstorming on the blackboard. Be sure students are aware of rules before brainstorming begins.

Rules for Brainstorming

1. In brainstorming, every idea, however crazy it may sound, is welcome.
2. No one should criticize anyone's ideas! In other words, no comments, no laughter, no funny looks.
3. The goal of brainstorming is for the group to produce as many ideas as possible. Original, zany ideas are welcome.
4. "Hitchhiking" is desirable. That is, if a good idea comes by, pick it up and add to it.

G. List student responses on chalkboard. Do not edit responses. (Set a time limit, probably not more than 20 minutes.)

H. Have the class categorize energy uses by type. (They might categorize uses into transportation, household use, industrial use, etc. Let students decide on their own categories.)

I. To end the lesson say something like "If all the energy uses you thought of were grouped into four major categories -- transportation, residential, industrial, and commercial -- which category would use the most energy? Which would use the least? Record student responses on the chalkboard. Then project the transparency: "Breakdown of U.S. Energy Consumption." Who was right?

NOTE: While the data on the transparency is from 1968, the percentages in the four categories apply with little change today.

SUGGESTED EVALUATION STRATEGY:

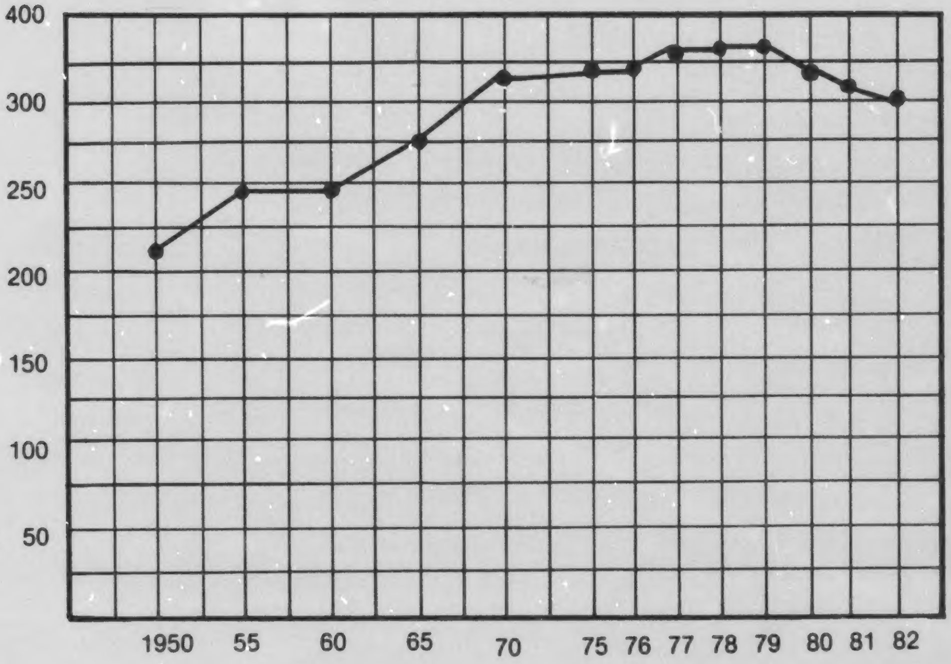
1. Develop a set of true/false questions dealing with energy consumption per capita, trends in consumption, and uses of energy. Use information in the lesson to generate these questions.

2. Have students list several uses for energy. Have them identify which are transportation, residential, commercial and industrial uses.

SPIN OFF

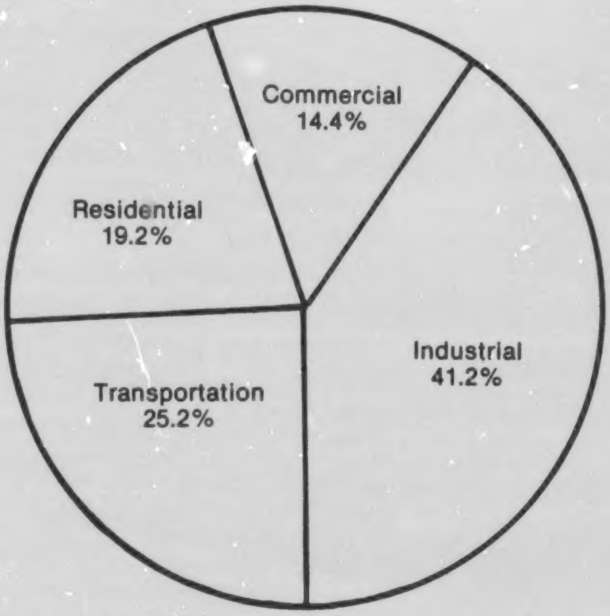
Invite representatives from one or more major energy users to class. In each case, have them detail how energy is used in their sector (e.g., "home use" - space heating, air conditioning, water heating, refrigeration, etc.). Then have each representative discuss what measures are being taken to reduce waste in his or her particular sector.

U.S. ENERGY CONSUMPTION PER CAPITA, 1950 to 1982



Source: U.S. Energy Information Administration. Information for 1981 and 1982 are estimates.

BREAKDOWN OF U.S. ENERGY CONSUMPTION, 1968



Source: Patterns of Energy Consumption in the United States, Office of Science and Technology, Executive Office of the President, Washington, D.C., 1972

LESSON 2: OUR CURRENT ENERGY SOURCES

CONCEPT: Productive resources/natural resources

RECOMMENDED USE: Middle school

TIME REQUIRED: 1-2 class periods

MATERIALS REQUIRED: Student materials included

ECONOMICS IN THIS LESSON:

Before goods (e.g. gasoline) and services can be consumed, they must be produced. For this to happen productive resources are necessary. Productive resources constitute the input of production.

Natural resources are one type of productive resource. They are elements of the natural environment that are used to produce goods and services and thereby help people meet their needs.

Natural resources include land, water, oil and mineral deposits, the fertility of the soil, climates suitable for growing crops, timber and so on. Some of these resources are non-renewable. These are used up in the process of production. Others renew themselves or can be renewed through human effort. These are renewable natural resources.

RATIONALE:

As a background for understanding our current energy situation, it is important for students to realize that most energy sources now being used in this country are non-renewable. They are being depleted as they are used to produce energy.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify the characteristics of a natural resource;
2. distinguish between renewable and non-renewable resources;
3. list the natural resources that are currently our main energy sources;
4. characterize current energy sources as renewable or non-renewable;
5. describe some implications of our dependence on non-renewable energy sources.

SUGGESTED TEACHING PROCEDURE:

A. Have students read through paragraphs 1-4 in the student materials.

B. As a class, review the characteristics of a natural resource (Paragraph 1). Record the characteristics on the chalkboard:

1. A natural resource is an element of the natural environment.
2. It is used to produce something that people use to satisfy needs.

C. Review the examples of natural resources in paragraphs 2 and 3 and the "non-example" of a natural resource in paragraph 4. (A tornado is a "natural hazard." It is introduced here to show that not every element of the natural environment is a natural resource.)

D. Have students examine the list in paragraph 5 and identify the natural resources on the list. They should respond copper, petroleum, wind, soil, water and natural gas. (There might be some debate about whether or not wind is a natural resource. It depends on velocity. If there is too little or too much velocity, wind is not a natural resource. In between these extremes it can be harnessed to produce usable energy, so it is a natural resource.)

E. Have students answer the question posed in paragraph 6. A variety of responses is possible.

F. To complete this section of the lesson, have students provide other examples of natural resources. In each case they should be asked what the resource is used to produce.

G. Have students read through paragraphs 7-10%

H. As a class, review the characteristics of renewable and non-renewable natural resources (paragraphs 7 and 9). Record the characteristics on the chalkboard.

Renewable	Non-Renewable
● element of the natural environment	● element of the natural environment
● used to produce things people use to satisfy needs	● used to produce things people use to satisfy needs
● the current stock can be used up; but supply can be replenished or replaced.	● cannot be restored; can be used up; supply is depleted when used.

I. After reviewing the examples in paragraphs 8 and 10, have students give other examples of renewable and non-renewable natural resources. In each case they should be asked to explain why it is renewable or non-renewable.

J. Before students examine the pie graph, you might want to review the material in paragraphs 11 and 12 as a class. Paragraph 11 is a reminder of what a pie graph shows. Paragraph 12 outlines a procedure for determining what a pie graph is about.

K. Have students answer the question posed in paragraph 12. They should say something like "This is a pie graph about the natural resources used to produce energy in this country in 1982. The graph shows what portion of all energy produced was contributed by each natural resource. It is based on information from the Department of Energy."

L. Have students follow the directions outlined in paragraph 13 and 14. (Note: Some students may not realize that water is used to produce electricity. Also in some situations it may be necessary for students to do some research in order to determine how to group these resources.) Their lists and calculations should look like this:

Renewable		Non-Renewable	
Water	3.8%	Domestic petroleum	25.9%
		Imported petroleum	17.2
		Domestic natural gas	25.1
		Nuclear Fuels	4.4
		Imported natural gas	1.2
		Domestic coal	22.4
	3.8%		96.2%

M. Have students list what they have learned about energy sources now used (paragraph 15). This listing can be done as an individual assignment or as a group activity. Students should come up with findings like:

1. Only five different natural resources are used to produce almost all of our energy at the present time.
2. Most of our energy is produced from non-renewable resources.
3. Coal, natural gas and petroleum account for over 90 per cent of our energy sources.

N. In paragraph 16 students are asked to speculate about the meaning of what they have learned. You might begin by listing what students learned about energy sources on the board. Then let them generate questions for an energy production expert. They might ask things like:

- When will our current energy sources run out if we keep using at the same rate?
- What is being done to develop renewable energy sources? Are new supplies of our non-renewable energy sources being found?
- What is being done to assure a supply of energy if our current non-renewable sources run out?

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define a natural resource. Have them give an example and explain why it is a natural resource.

2. Ask the students to list 3 characteristics of renewable resources and of non-renewable resources.

3. Give students a list of natural resources not previously seen. Have them distinguish between renewable and non-renewable ones.

4. Give students a list of 10 possible energy sources. Have them characterize these sources as renewable or non-renewable. Then have them identify which 5 sources on the list are currently our major energy sources.

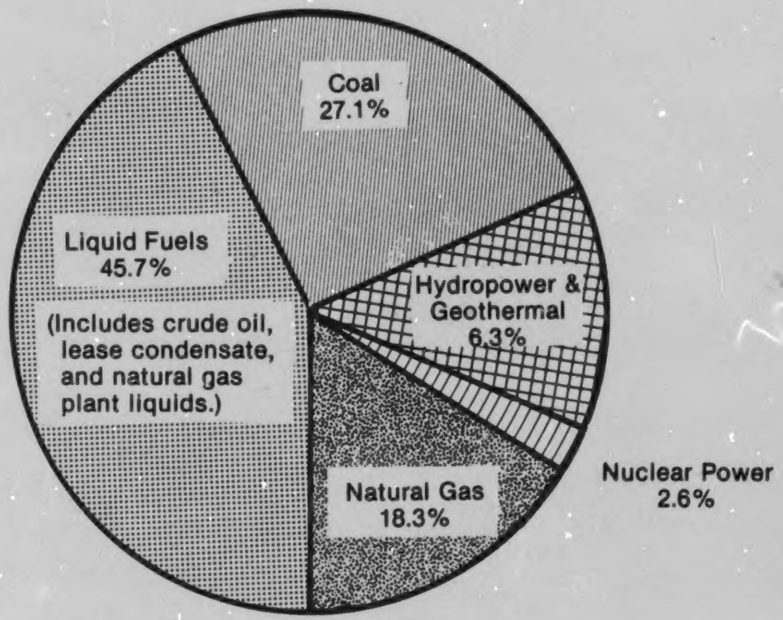
5. Have students write a short paragraph describing some of the possible consequences of our dependence on non-renewable energy sources.

SPIN OFF:

Have students examine pie graphs for other historical periods and other parts of the worlds. They can respond to questions similar to those in paragraphs 12-16 of the student materials. Some useful pie graphs appear on the following pages.

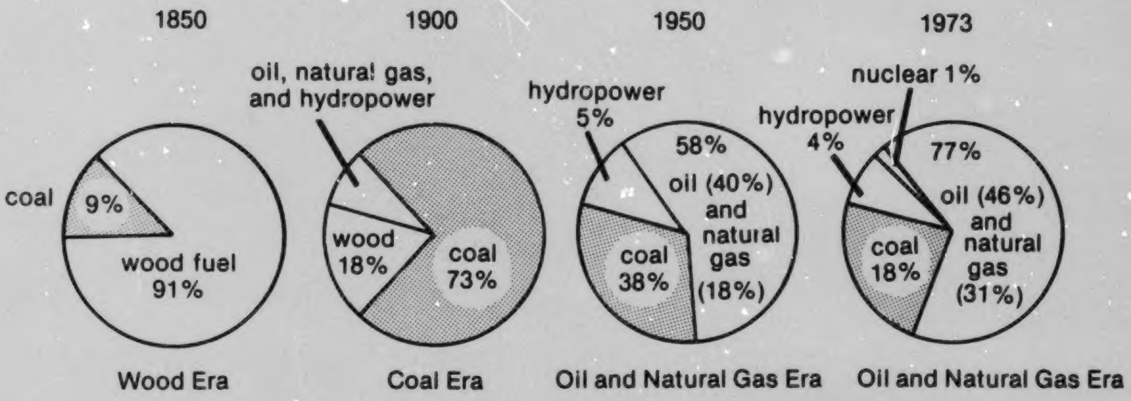
SOURCES OF WORLD PRIMARY ENERGY IN 1980 (Preliminary)

Include only crude oil, lease condensate, natural gas plant liquids, dry natural gas, coal, net hydroelectric power, and net nuclear power.



Source: Based on data from: 1980 International Energy Annual. September, 1981. pp. 7-12.

CHANGING PATTERNS IN THE USE OF ENERGY RESOURCES IN THE UNITED STATES



(Data from the U.S. Bureau
of Census and Resources for
the Future) G.T. Miller.
Energy and Environment:
Four Energy Crises

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STUDENT MATERIALS: OUR CURRENT ENERGY SOURCES

1. A natural resource is an element of the natural environment. It is used to produce something. People use the things produced from natural resources to satisfy their needs.

2. A tree is a natural resource. It is an element of the natural environment that is used to build houses, to build cooking fires, and to make paper. Houses, cooking fires, and paper, in turn, are used by people to satisfy their needs.

3. Iron ore is also a natural resource. It is an element of the natural environment that is used to make steel. People use steel to satisfy many different needs.

4. Is a tornado a natural resource? It is an element of the natural environment. But it is not used to produce anything that people use to satisfy their needs. So a tornado is not a natural resource.

5. Identify the natural resources in the following list:

   blizzard
   copper
   petroleum
   wind
   earthquake
   hailstones
   soil
   water
   locusts
   natural gas

6. What is each natural resource on your list used to produce?

7. Sometimes it is useful to distinguish between two kinds of natural resources. One kind is called a renewable natural resource. This means that the supply of the natural resource can be replaced or restored as it is used.

8. When a forest is cut down it will grow again. The fertility of the soil can be restored when it is exhausted. Soil can be restored naturally or by human effort. When the supply of water in a well is low, rains come to replenish it. Forests, soil and water are examples of renewable resources.

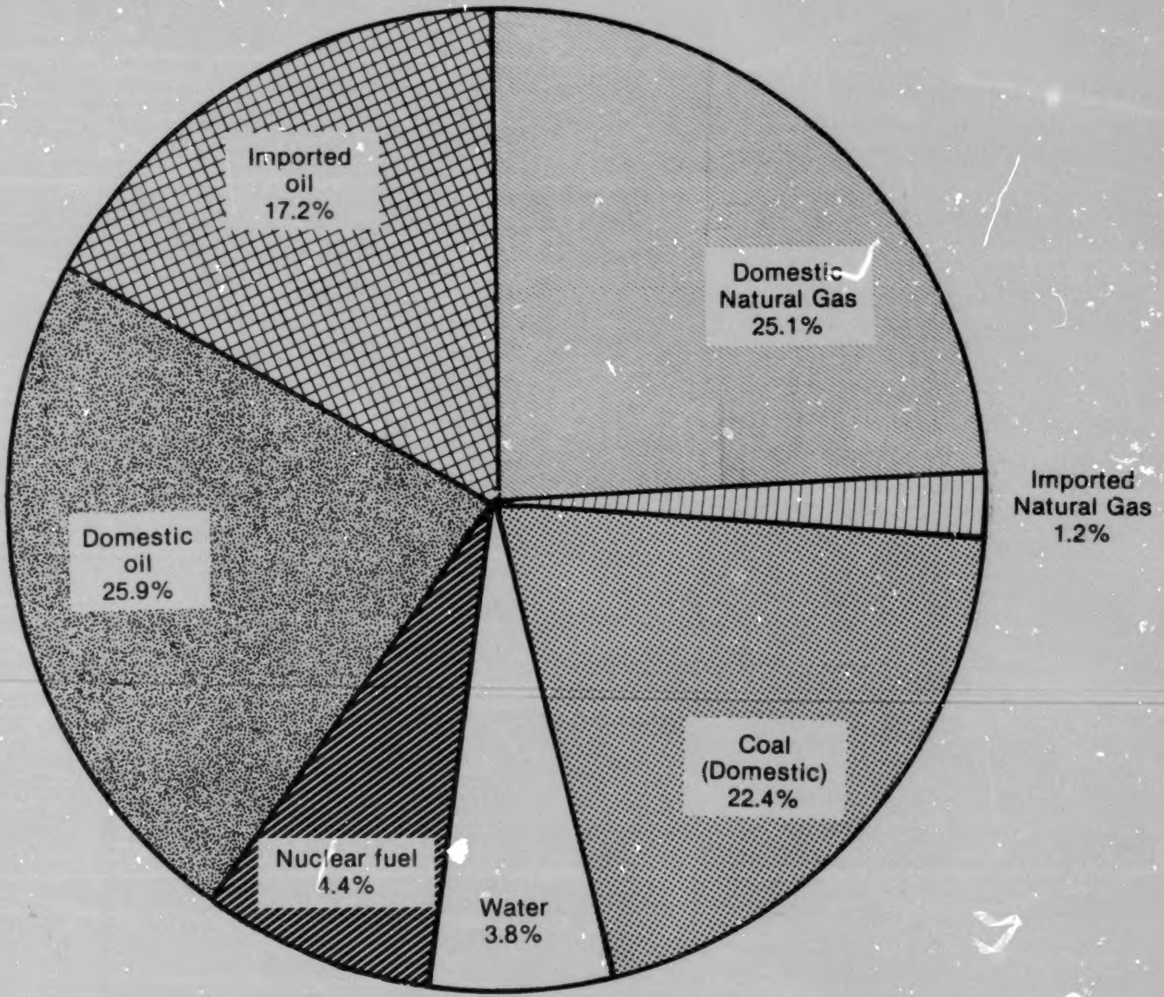
9. Other natural resources are non-renewable. They can be used up.

10. Iron-ore and copper are examples of non-renewable resources. As they are used to produce things like steel and wire, they cannot be replenished. The earth's supply of these natural resources becomes less and less as they are used.

11. Examine the following graph. Remember that in a pie graph the pie is used to represent a whole. "Slices" are drawn to show the portions of the whole. The size of each slice shows how much that portion contributes to the whole.

12. What is the pie graph about? To answer this question inspect the graph title, check the graph source, and examine the information in each "slice" of the pie graph.

NATURAL RESOURCES USED TO PRODUCE ENERGY IN THE U.S. 1982



Source: U.S. Department of Energy, August, 1981

13. To learn what the pie graph says, begin by making two lists. Place all the renewable natural resources shown on the pie graph on one list. Place the non-renewable energy sources on the other list.

14. Then, calculate what portion of all the energy produced in the U.S. in 1982 came from renewable natural resources. What portion came from non-renewable sources?

15. List two things that you have learned from the pie graph about natural resources now used to produce energy in the U.S.

16. In this lesson you have learned some things about our present energy sources. In view of what you have learned, what are some questions you would ask an energy production expert, (economist), if he/she visited your class?

LESSON 3: WHAT IS NEEDED TO PRODUCE ENERGY?

CONCEPT: Productive resources: labor, capital, and natural resources

RECOMMENDED USE: Middle school

TIME REQUIRED: One class period

MATERIALS REQUIRED:

This lesson begins with the teacher demonstrating the production of an item. In this outline the production of a "bookend" is featured. You can make almost anything as long as it involves clear and simple examples of labor, capital goods, and resources (see below for definitions of these terms).

If you decide to make a bookend you will need:

- hammer
- nails
- 2 pieces of wood (get two pieces of scrap from the school shop instructor that are the same width (say about 5") and between 5" and 8" long. You can nail these together to form a crude bookend.

Also needed for this is the student worksheet "Using the Factors of Production to Get Energy." A blackline master is provided.

ECONOMICS IN THIS LESSON:

Before goods (e.g., gasoline) and services can be consumed, they must be produced. For this to happen, productive resources (also called factors of production) are necessary. Productive resources are the inputs to production. Goods and services are the outputs.

There are three kinds of productive resources. Natural resources are elements of the natural environment that are used to produce goods and services. Natural resources include land, water, oil and mineral deposits, the fertility of the soil, climates suitable for growing crops, timber and so on.

Human resources (labor) are people and their physical and mental capacities. The number of people available for work, the hours they work, the quality of their skills and their motivation are all dimensions of labor input.

Capital goods are those things created by past human effort that are available to produce goods and services in the future. They include machines, tools and factories.

RATIONALE:

As a background for understanding issues related to the production of energy, it is important for students to understand that the production of any good involves inputs of natural resources, capital goods, and labor.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify the characteristics of the three factors of production;
2. distinguish among examples of labor, capital, and natural resources;
3. illustrate the need for all three factors in the production of energy.

SUGGESTED TEACHING PROCEDURE:

A. You might begin the class by saying:

"You know, I need a bookend. People always need one thing or another. So what do they do? They go out and buy it, or they find someone to make it for them. Sometimes they can make it themselves. That's what I'm going to do. I'm going to make a bookend."

"To make my bookend, I'll use this wood. I'll nail these two pieces together with my hammer. Maybe one of you can hold the pieces while I nail. OK, here is my bookend."

B. Ask students "What was needed to build the bookend that you just made?" Have them answer as a class. Write answers on the blackboard. They might respond:

"You had to nail the pieces of wood together"
"You needed wood."
"Work had to be done."
"You used a hammer."
"You had to have something to make the bookends out of."
"You needed tools."
"You used nails."

C. When the students run out of suggestions, point out that building this bookend was a simple project. It was like all production projects. The same three things are needed to produce all goods. Write them on the board along with definitions:

(i) Labor: Human time and effort.
(ii) Natural Resources: Things we take from nature, like ores, air, water, and sunshine.
(iii) Capital Goods: Things people have made in the past that they can now use to make more things, like factories, saws, and can openers.

D. Next use one statement from the student list (generated in response to the questions in Step B, above) to illustrate each of the three factors of production. You might choose:

Labor: "You had to nail the pieces of wood together."
Natural Resources: "You needed wood."
Capital Goods: "You used a hammer."

These are called factors of production. Anything that is produced requires the input of all three.

E. Have the students categorize the other statements on the list as examples of labor, natural resources, or capital goods. They should respond:

Labor: "Work had to be done."

Natural Resources: "You had to have something to make the bookend out of."

Capital Goods: "You needed tools."
"You used nails."

F. Pass out the worksheet "Using the Factors of Production to Get Energy." Have students read the directions for each section. Do the first examples from section A and section B as a class. Students should respond:

Section A, Question 1 - Sawing the wood into chunks is labor.

Section B, Question 7 - Labor: Felling the trees, cutting the wood, stacking it, stoking the stove, cleaning the chimney, removing ashes.

Capital - Ax, chain saw, wood stove, perhaps a wheelbarrow, or truck, chimney, stove shovel, ash pail.

Natural Resource: Wood.

NOTE: Answers given here in Section B are typical. There are other answers that are equally correct.

G. Ask students to complete the worksheet during the remainder of the class period. Circulate and check answers. (You might want students to work in pairs.) Students might respond as follows:

Section A

Question: 2. Tanker trucks are capital resources.

3. The pipeline system is a capital resource.

4. The plumber's work in installing the system is labor.

5. The drilling rig is capital equipment. It is a tool people made.

6. The dam, turbine, and generator are capital equipment.

Section B

Question: 8. Labor: Work of plant engineers, work of linemen.
Capital: The nuclear power plant, the transmission, and distribution system, the toaster. Going farther back in the nuclear fuel cycle, other capital equipment required would include the equipment at the uranium mine and the milling and enrichment facilities.
Natural Resource: Uranium.

9. Labor: Work of the factory workers.
Capital: The factory building itself, the melting pots, and other equipment.
Natural Resources: Natural gas, sand, other ingredients in the glass.

10. Labor: Workers on the rig, refinery workers, tank truck driver, service station attendant.
Capital: Ships, rig, tank truck.
Natural Resource: Crude oil.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define labor, capital goods, and natural resources. Have them give an example of each.

2. Have students answer questions similar to those posed in Section A of the student worksheet "Using the Factors of Production to Get Energy."

For example:

To do this...	Requires this...	What is it?
1. Fly from Chicago to New York	oil refinery workers run refinery	(Answer-Labor)
2. Truck Beef to market	crude oil	(Natural resource)
3. Make glassware	natural gas	(Natural resource)
4. Cook a meal on a gas stove	watching the pot	(Labor)
5. Pump water with windmill	wind	(Natural resource)

3. Have students answer questions similar to those posed in Section B of the student worksheet "Using the Factors of Production to Get Energy." For example:

6. A farmer uses a windmill to pump water for irrigating his crops.
Labor: (Answer-maintain windmill)
Capital: (Pump, tower, windmill blades)
Natural Resource: (Wind. Also other resources were used to create capital resources and in obtaining energy from wind.)

7. Two kids watch TV. The electricity comes from a power plant burning coal that was mined underground hundreds of miles away.
Labor: (Coal miner, power plant workers, linemen)
Capital: (Coal miner equipment, railroad, power plant, electricity wires)
Natural Resource: (Coal, water for cooling, air for combustion)

SPIN OFF

Have students collect articles describing the production of energy in different historical periods or in different parts of the world. Have students identify the labor, capital, and natural resource inputs used to produce energy in each case.

WORKSHEET

USING THE FACTORS OF PRODUCTION TO GET ENERGY

REMEMBER:

LABOR is people's time and effort.
CAPITAL is anything people have made in the past that can be used to make more goods and services. A hammer is capital, and so is a truck, a factory, or a road.
NATURAL RESOURCES are things we take from nature, like ores, water, air, and sunshine.

SECTION A: Listed below are some ways people can get energy. To obtain this energy, it is necessary to use labor, capital, and natural resources. Write either "labor," "capital," or "natural resource" in the blank space at the end of each line, to describe what the thing in the second column is.

To do this...	Requires this...	What is it?
1. Heat a home with a wood stove	sawing wood into chunks	
2. Heat a home with fuel oil	tanker truck	
3. Heat a home with natural gas	pipeline system	
4. Heat a home with a solar collector	installation by plumber	
5. Move a car using gasoline	drilling rig	
6. Light a home	dam, turbine, and generator	

SECTION B: To get energy, it is necessary to use labor, capital, and natural resources. Below are some ways people get energy. For each way of getting energy, give an example of labor, capital, and a natural resource used. There are many possible right answers.

7. A family heats its home with a wood stove, using wood the family members cut in their own woodlot.
Labor:______________________________

Capital:______________________________

Natural Resource:______________________________

8. A boy makes toast in an electric toaster using electric energy from a nuclear power plant.
Labor:______________________________

Capital:______________________________

Natural Resource:______________________________

9. A glassware factory uses natural gas to melt glass, and makes bottles.
Labor:______________________________

Capital:______________________________

Natural Resource:______________________________

10. A man burns gasoline in a car to drive to the supermarket. The gasoline was made from crude oil from an off-shore oil rig.
Labor:______________________________

Capital:______________________________

Natural Resource:______________________________

LESSON 4: ENERGY ALTERNATIVES

CONCEPTS: Costs and benefits, decision making

RECOMMENDED USE: Middle school

TIME REQUIRED: 2-3 class periods

MATERIALS REQUIRED: Handouts: "Background"
"Proceedings"
"Costs and Benefits"
"Review Sheet"
Blackline masters of student handouts are provided.

ECONOMICS IN THIS LESSON:

When a person or a group chooses one type of goods instead of another, they are making a trade-off -- that is, they may be trading off less of one thing for more of something else. Society has to make trade-offs too, e.g., between its need for more energy and its desire to preserve the environment. Essentially this involves comparing the various costs and benefits of each of the alternatives. It also involves determining how these costs and benefits will affect different groups within the economic system.

RATIONALE:

It is important for students to realize that whenever a decision is made, there are costs and benefits associated with it. The purpose of this lesson is to give students an opportunity to begin to identify the benefits and costs, the good news and bad news respectively, associated with the use of different energy sources. Identifying costs and benefits associated with alternatives is an important step in learning how to make well-reasoned decisions.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify some of the costs and benefits associated with certain energy alternatives;
2. use costs and benefits to make decisions about energy alternatives.

SUGGESTED TEACHING PROCEDURE:

NOTE: In this lesson students will participate in a simulation. The simulation revolves around the meeting of the Board of Directors of an electric utility. They are trying to choose between building a coal- or a nuclear-powered plant.

You may want to use the materials included in this lesson exclusively. It is complete. However, you may want students to supplement what is contained in these materials by doing some research.

A. To begin this lesson have students read the "Background" handout. Review the basic facts as a class:

- i) A study shows that in 10 years electricity production will not match anticipated consumption.
- ii) Using oil to generate electricity is too expensive.
- iii) Board members decide to build another large plant.
- iv) They must choose an energy source for the plant - coal or nuclear.

NOTE: Other energy alternatives like solar, wind, etc., are not yet able to generate 500 MW in one place.

- v) A hearing is to be held to hear presentations by representatives of the coal and nuclear industries. People concerned about the environmental impact of coal and nuclear energy will also be speaking.
- vi) As the simulation begins, the meeting is about to start.

B. Distribute the "Procedures" and assign roles. You might ask students to review their parts over night before the hearing is held. You will need to assign the following roles. Outline responsibilities of each role to students selected.

Chairperson: Board of Directors - runs the meeting

Lawyers (6) - make presentations for the environmentalists and the energy companies.

Witnesses (3) - make presentations related to lawyers' statements

Recorder: played by teacher - keeps record of the key points made (might use a tape recorder)

Board of Directors (remaining class members) - listen to presentation, ask questions of presenters, and make a decision.

NOTE: The handout "Costs and Benefits" should be distributed to Board of Directors. Tell them to use these forms to keep track of the costs (disadvantages) and benefits (advantages) associated with the two energy sources, as they listen to the presentations.

C. When everyone is ready, the Executive Session of the Metro Power and Light Company Board of Directors should begin. Events should follow the "Proceedings."

D. After all statements are made and questions are asked, the Board Members must debate among themselves the merits of the two energy sources. Divide the class into groups. (Let the lawyers, witnesses, and chairperson join groups.) Have each group come to a decision. Encourage them to make their decision based on the costs and benefits associated with each resource.

E. Each group should announce its decision. Decisions can be announced in a variety of ways - in a classic "form letter", in the school newsletter or newspaper, etc. The announcement should contain a rationale.

NOTE: You can decide what form the final decision should take or let the Board decide.

SUGGESTED EVALUATION PROCEDURE:

To conclude this lesson, have students complete the "Review Sheet." This can be assigned as an in-class activity or as homework. You might consider using student answers to these questions to measure what they learned in this lesson. In any case, student answers to these questions should be discussed as a group to end the lesson.

SPIN OFF

You might have students examine a number of alternative sources of energy not considered in this lesson, using the criteria developed here as a framework.

A reasonable task would be to compare three energy alternatives that can be used to produce electricity, using the chart developed in this lesson. The FREE AND INEXPENSIVE RESOURCES section of this unit lists several sources of information for this task.

BACKGROUND

Last year the Metro Power and Light Company (MPLC) conducted a study. The purpose of the study was to estimate future electricity needs in the region served by MPLC. The study showed that in 10 years there would be a problem. Electricity production would fall short of expected consumption by 500 megawatts (MW).

In the past MPLC always solved its energy problems in the same way. It built a new electric generating plant that used oil for fuel. Now the price of oil is so high that another solution must be found.

The MPLC Board of Directors reviewed the study of future electricity consumption in the region. They quickly decided to build another big electrical generating plant to provide the additional 500 MW of energy needed.

The Board of Directors knows something about energy alternatives. They realize that only two possible energy sources could be used to power such a plant in the next several years. They would have to choose between nuclear energy and coal. But which one should they choose?

Most of their experience had been with oil-powered plants. Therefore, the Board of Directors of MPLC felt that they could not choose between coal and nuclear energy without more information.

They decided to hold a meeting. They invited experts from the coal and nuclear industries to make statements. People concerned with the environment were also invited. After all the information is gathered from the speakers, the Board will make a decision.

HANDOUT

PROCEEDINGS

Public Meeting
Metro Power and Light Company
Board of Directors

CHAIRPERSON: Welcome to this meeting called by the Board of Directors, Metro Power and Light Company. Coal and nuclear energy are dependable sources for making electricity. But we use both at great risk to our environment and health. Let's look first at the environmentalists' side of the story. Then we shall listen to the coal and nuclear power experts and hear their side of the story. Lawyers for the environmentalists, would you state your case?

LAWYER ONE (Environmentalists): Many people depend on electricity in their homes and on their jobs. Certainly coal is an important resource for generating electricity. But getting the coal from the ground hurts the environment. Strip mining damages large areas of land. A huge machine removes the soil to get the coal. This kind of mining causes erosion of the land. Often there are landslides and falling rocks.

Underground mining is damaging also. Water seeps into the abandoned mines and mixes with sulfur from the coal to make acid mine drainage which kills fish and often colors the stream red.

Ladies and Gentlemen of the Board, coal mining is also dangerous to the miner's health. Black lung disease has cost the miners the loss of their money and their lives. Coal miners usually have short life spans. Many miners get hurt in mine accidents, too. I would like to call Mr. Will Banks. He has black lung disease.

COAL MINER WITNESS: (Coughing while talking) I have worked in No. 5 mine for 25 years. I narrowly avoided being killed when I first started working in the mine because part of the mine caved in. Then, last year, I got black lung disease from breathing the coal dust. It is a disease, the doctors tell me, which gets worse each year, and I will no longer be able to work. I tell my sons not to work in the mines. Even though they now train miners to avoid accidents and the pay is good, it is too dangerous a job.

LAWYER TWO (Environmentalists): You have just heard the hazards in mining coal. Making electricity with coal is another problem. Burning coal in power plants gives off hot gases, particulate matter, and sulfur which makes the air dirty. The sulfur combines with the water vapor in the air to make something that smells like rotten eggs and affects respiratory systems. Carbon dioxide is also given off. Some scientists believe that it changes the climate.

The coal wastes, or ash, are hazardous materials. They have to be disposed of carefully. The hot water generated when steam is produced from the burning coal is dumped into nearby rivers and lakes. This changes the environment of the plants and animals that live there.

Even after the electricity is made, there are environmental problems. Ladies and Gentlemen of the Board, you have seen utility poles carrying high tension lines. You know how ugly they are! These utility poles and miles of cables needed use up a lot of land. When these high tension lines interfere with your favorite TV program, then, something must be done!

LAWYER THREE (Environmentalists): Nuclear power is used primarily to make electricity from steam in large power plants. Uranium is the basic fuel and is found in ores and mined in the western part of the United States. In the mining of the uranium ore, uranium tailings are buried deep in the ground. Uranium is radioactive for a long period of time. It can be dangerous to the health of those people living on sites where the uranium tailings are buried. I would like to call a witness.

WITNESS (Young woman with gray hair): My name is Mrs. Emma Hurt and I am 29 years old and have 3 young children. I live in Grand Junction, Colorado. The radioactivity readings where I live are high due to the burial of uranium tailings under the town. The doctors have just told me that I have leukemia, a form of cancer of the blood, and only have a few years to live. Who is going to raise my children?

LAWYER FOUR (Environmentalists): Ladies and Gentlemen of the Board, you have just heard about the kind of health problems that can occur in uranium mining. There are other problems in the generation of electricity. One is a problem of waste heat. Nuclear power plants have more waste heat than coal fired plants and discharge all their waste heat into the cooling water. This cooling water can kill the fish in nearby streams or oceans. Some scientists also believe that radiation is higher around nuclear power plants.

But the biggest problem is what to do with the nuclear wastes or used fuel from these power plants. These wastes are stored in steel drums near the power plants. They are poisonous and dangerously radioactive for millions of years. The government has not made a decision as to where they will store these wastes while they are radioactive. Most states do not want them stored anywhere near the people that live in their state. Future generations may suffer if a solution is not found to their problem in the next few years. We cannot let that happen!

CHAIRPERSON: Members of the Board, you have heard the case for the environmentalists arguing against the production of electricity by coal or nuclear power. Since this is a special case, I will now open the proceedings to questions from the Board. Are there any questions? (After the questions) Could we hear a summary of the environmentalists' case?

RECORDER: (Reads notes or plays back tape on the environmentalists' presentation.)

CHAIRPERSON: Now we will hear the case for the Energy Industries. First we will hear testimony from the Everywhere Coal Mining Company. Lawyer, would you state your case?

LAWYER FROM THE COAL COMPANY: Ladies and Gentlemen of the Board, I am here to show you and the people that coal mining is different today.

We need coal. We have an abundance of it in this state. Coal is used to make electricity for your TV and your kitchen appliances. Without coal many people would not have electricity for light.

We know that strip mining leaves ugly scars on the land. The coal mining companies now are bound by state law to restore the land to its natural and usable state.

Also, in 1970 the United States Congress passed the Coal Mine Health and Safety Act. Ladies and Gentlemen, all coal mining companies today spend a lot of time and money improving the working conditions of their miners and training them how to mine the coal so that our safety records are much, much better.

CHAIRPERSON: Now we will hear from the lawyer from the nuclear power plant.

LAWYER FROM THE NUCLEAR POWER PLANT: We have to use more electricity to keep our economy going! We need more large nuclear power plants so that we won't be dependent on foreign countries for our energy supplies.

It is cheaper to produce nuclear power than it is to produce power from coal. Also, it doesn't cause any air pollution problems.

Nuclear power plants produce less radiation than your color TV set does or the granite in buildings in New York City.

Our safety record is excellent. Even considering the Three Mile Island accident, no member of the public has suffered physical harm from a nuclear power plant. Statistics show that this is not true for coal.

As for the storage of radioactive wastes, we have that problem solved. May I call on an expert witness to address that problem? Professor Alvarez from State Technical University, will you please come to the stand?

WITNESS, SCIENTIFIC EXPERT: My name is Professor Alvarez. I am a nuclear engineer from State Technical University. We have done many studies on the storage of long term radioactive wastes. Our pilot program in Nevada shows that making the wastes into a solid and storing them in underground salt formations will protect those wastes from ever leaking any radiation into the atmosphere. We have presented our findings to the government officials.

CHAIRPERSON: Thank you Professor Alvarez. Do the members of the Board have any questions for these lawyers? (Answer questions) Could we have a summary of the case for the coal and nuclear utility companies?

RECORDER: (Reads or plays the notes of the coal company and nuclear industry presentations.)

CHAIRPERSON: The Board is excused to deliberate. Remember that you are to decide which source of generating electricity is better to use while protecting the environment.

HANDOUT

COSTS AND BENEFITS

	COSTS (Disadvantages)	BENEFITS (Advantages)
Coal		
Nuclear		

REVIEW SHEET

1. What were two things about coal that made it seem like a reasonable energy source for the Board to choose? How about two disadvantages?

2. What were two things about nuclear energy that made it seem like a reasonable energy source for the Board to choose? What are two disadvantages?

3. If you were asked to choose between coal and nuclear energy to power a large electricity generating plant, which would you pick? Why?

LESSON 5: WHAT DO YOU GIVE UP TO PRODUCE ENERGY?

CONCEPT: Opportunity costs

RECOMMENDED USE: Middle school

TIME REQUIRED: 1-2 class periods

MATERIALS REQUIRED: Worksheet "Other Uses for Resources That Could be Used to Get Energy"
Blackline masters included.

ECONOMICS IN THIS LESSON:

Opportunity cost refers to what must be given up when decisions are made to use scarce productive resources to produce particular goods or services. A decision to produce one good means giving up the possibility of producing something else. Thus, the opportunity cost - what could have been produced with the resources instead - is the cost of producing that good. For an individual, the opportunity cost of something purchased is the next best opportunity that must be foregone. For a society, it is the next best alternative use to which productive resources could have been put.

RATIONALE:

When decisions are made to use scarce resources to produce energy, opportunity costs are involved. Another use of these resources is foreclosed. Citizens must be sure that energy decisions are based on a clear understanding of the opportunity costs involved.

INSTRUCTIONAL OBJECTIVES

On completion of this lesson, learners will be able to:

1. define opportunity costs;
2. identify the opportunity costs involved in decisions involving the use of scarce resources.

SUGGESTED TEACHING PROCEDURE:

A. Have students read paragraph 1 in the student materials.

B. Ask students why they think "time" is considered a scarce resource in paragraph 1. They might respond - "because there are only a limited number of hours in a day but there are numerous ways people want and are able to use that time."

C. Have students read paragraph 2. Review its meaning as a group. Ask them who must make a decision about the use of time. (Answer: Me, a basketball player.) Ask them what the alternatives are. (Answer: Practice basketball or work at the grocery store.) Here is a situation where a choice must be made about the use of a scarce resource - time.

D. You might ask students to describe situations in which they have been faced with choosing between alternative ways of using scarce resources - like time or income. NOTE: Record student examples for later use.

E. Have students read paragraphs 3-5. As a class, review the characteristics of opportunity cost:

a. Not measured in money;
b. Refers to the next best use of a resource that is foregone when a decision is made to use that resource in a particular way.

F. Review the examples of opportunity costs in paragraphs 4 and 5. It is important for students to realize that opportunity costs are the next best opportunities passed by or foreclosed.

G. Have students follow the directions contained in paragraph 6. They should respond:

a) The girl's time is limited. She must choose how to use it. The opportunity cost of her decision to go with one boy is not being able to go to the dance with the other boy.

b) The lot is the scarce resource. The opportunity cost of using the lot for a park is not being able to use it for a parking lot.

c) Steel is the limited resource here. The opportunity cost of building the bridge is not being able to build the hospital.

H. Return to the student descriptions of decision-making situations generated in response to Step D, above. Have students apply the questions asked in paragraph 6 of the student materials to their examples.

I. In paragraph 7 of the student materials attention focuses on energy. Have students follow the directions contained in paragraph 7. (If your students have completed the lesson "What Is Needed To Produce Energy?", ask them to identify which resources in the stories are natural resources, capital goods and labor.) They should respond:

a) natural gas; to heat homes or to make fertilizer; not being able to use the natural gas for fertilizer. (Natural gas is a natural resource.)

b) crude oil; to make gasoline or to make plastics; not being able to use that crude oil to make plastics. (Crude oil is a natural resource.)

c) concrete; to make buildings for a nuclear power plant or to build dams; not being able to use that concrete to build dams. (Concrete is a capital good.)

d) land; for a windmill or a radio antenna; not being able to build a radio antenna there. (Land is a natural resource.)

e) the skilled workers; to find and produce more energy or to create other goods; not using the workers to create other goods. (Skilled workers are an example of labor.)

NOTE TO TEACHER: Students might argue that there is more than one alternate way to use each of the resources described in the stories. You should point out that opportunity costs refer to the next best use to which a resource can be put.

J. End the lesson by pointing out that students and their families must recognize the opportunity costs involved in the decisions they make as energy consumers. For example: What next best use of a family's limited income is given up when a large portion of that income is spent on gasoline to keep the family station wagon going? (This is a topic considered in detail in another lesson. But it is an important point to make now.)

Point out also that as citizens, students have a responsibility to oversee how energy decisions are made in their communities and nation. One important aspect of that monitoring involves watching the extent to which opportunity costs have been considered in energy decision making.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define opportunity costs. Have them give an example from their own experience.

2. Develop a series of short stories similar to those contained in paragraph 7 of the student materials. Use the questions in paragraph 7 to test students' ability to identify the opportunity costs involved in decisions involving the use of scarce resources to produce energy.

SPIN OFF

The worksheet entitled, "Other Uses for Resources That Could Be Used To Get Energy" will give students additional practice in identifying opportunity costs involved in energy production. The worksheet contains a list of resources. Beside each resource is an example of how it can be used to produce energy. The students' task is to suggest the next best use for that resource. Let students use their imagination. Accept all reasonable answers.

a) natural gas; to heat homes or to make fertilizer; not being able to use the natural gas for fertilizer. (Natural gas is a natural resource.)

b) crude oil; to make gasoline or to make plastics; not being able to use that crude oil to make plastics. (Crude oil is a natural resource.)

c) concrete; to make buildings for a nuclear power plant or to build dams; not being able to use that concrete to build dams. (Concrete is a capital good.)

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STUDENT MATERIALS: OPPORTUNITY COSTS

1. All decisions involving the use of scarce resources force us to choose between alternatives. For most of us time is a good example of a scarce resource. We always have so much to do, but a limited amount of time to do it in. We must make choices about the use of our limited time.

2. Imagine that you are on your school's basketball team. After school each day you have two hours available before supper and homework. How will you use these two hours? You could go to basketball practice. The coach has a rule that players must attend all practices if they want to play in the weekend game against other schools. You could spend that time working at the grocery store. You want to earn money to buy your mother a birthday present. These are your alternatives.

3. Decisions have opportunity costs associated with them. Opportunity costs are not measured in dollars. They refer to the next best use of a resource that is passed up or foregone when a decision is made to use that resource in a particular way.

4. If you spend your time practicing basketball, then you will pass up a chance to earn money for a present. Not being able to earn money to buy your mother a birthday present is the opportunity cost involved in deciding to spend your time at basketball practice.

5. What if you decided to spend your time working at the grocery store? What would your opportunity cost be then? It would be not going to practice and therefore not playing in games against other schools.

6. All decisions made about the use of scarce resources involve opportunity costs. Below are three stories. In each case identify the resource about which a decision is being made. Then describe the opportunity cost involved in the decision.

   a) A girl has two different boys ask her to the same school dance. What is the opportunity cost of her decision to go with one boy?

   b) A city has a vacant lot that it can use for a city park or as a central parking lot. What is the opportunity cost involved in building the park?

c) A small country is able to purchase enough steel to build a bridge or a hospital. What is the opportunity cost of making the bridge?

7. Scarce resources are used to produce energy. Using those resources to produce energy means that they cannot be used to produce something else. What opportunity costs are involved in energy production? The following stories will help answer that question. For each story:

i) Identify the scarce resource about which a decision is being made.
ii) Identify the alternate use to which the resource can be put.
iii) Describe the opportunity cost involved in the decision.

a) A million cubic feet of natural gas can be used to heat homes. It can also be converted into fertilizer to grow food. What is the opportunity cost involved in using the natural gas to heat homes?

b) A million barrels of crude oil can be used to make gasoline for cars. It can also be made into plastics. What is the opportunity cost involved in using the crude oil to make gasoline?

c) A certain amount of concrete can be used to make the containment building of a nuclear power plant. It can also be used to build hydro-electric dams. What is the opportunity cost involved in using the concrete to build a nuclear power plant?

d) A windmill can be built on a certain piece of land. It is also a good site for a radio station antenna. What is the opportunity cost involved in building the windmill on that piece of land?

e) Fifty skilled workers could be used to find and produce more energy. These workers could also be used to create other goods. What is the opportunity cost involved in using them to find and produce more energy?

8. Energy production requires that decisions be made about the use of scarce resources. These decisions will involve opportunity costs. The next best use of these resources will be given up or foregone when they are used to produce energy. It is our responsibility as citizens to be sure that energy decisions are based on a clear understanding of the opportunity costs involved.

WORKSHEET

OTHER USES FOR RESOURCES THAT COULD BE USED TO GET ENERGY

Here are some resources. Name some uses for each resource, other than to produce energy.

Resource	Example of use to get energy	Example of use for another purpose
1. coal	burn it	
2. farmer's time	oiling windmill	
3. uranium	make into reactor fuel	
4. sunlight	grow trees for fuelwood	
5. drilling rig	drill for oil or gas	
6. iron pipe	make a pipeline for natural gas	
7. power shovel	use to surface-mine coal	
8. natural gas	to power compressors that push gas through the pipelines	
9. ship	carry crude oil from Africa to the United States	
10. wind	drive a windmill	

LESSON 6: NO WAY OF REDUCING ENERGY USE IS FREE

CONCEPTS: Opportunity costs

RECOMMENDED USE: Middle school

TIME REQUIRED: 1-2 class periods

MATERIAL REQUIRED: Student materials included

ECONOMICS IN THIS LESSON:

Opportunity costs refer to what must be given up when decisions are made to use scarce productive resources to produce particular goods and services. A decision to produce one good means giving up the possibility of producing something else. Thus, the opportunity cost - what could have been produced with the resources instead - is the cost of producing that good. For an individual the opportunity cost of something purchased is the other things that must be foregone. For a society it is the alternate uses to which productive resources could have been put.

When a person or a group chooses from among alternatives, this involves comparing the various costs (including opportunity costs) and benefits of each of the alternatives.

RATIONALE:

In deciding whether or not to undertake measures to reduce energy use, it is necessary to balance the costs of a particular measure against its expected benefits. Most people are aware of the benefits associated with energy use reduction measures. But do they realize that there are opportunity costs as well as monetary costs involved in implementing those measures? The purpose of this lesson is to examine the opportunity costs associated with decisions to reduce energy use.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

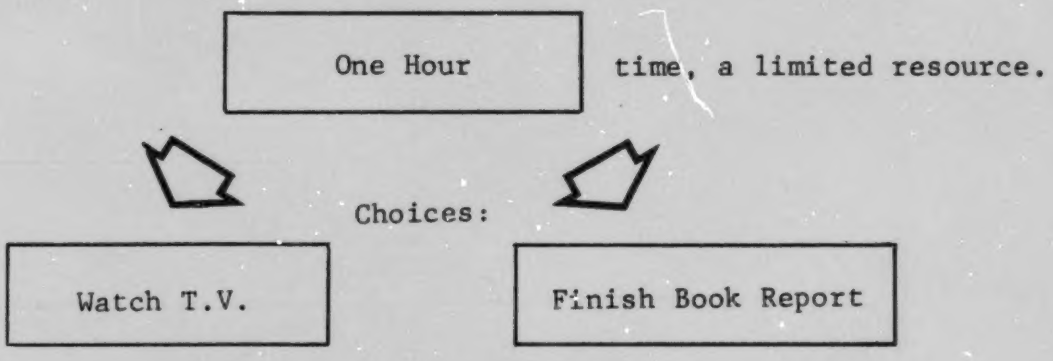
1. define opportunity costs;
2. describe opportunity costs involved in decisions related to reducing energy use.

SUGGESTED TEACHING PROCEDURE:

A. Begin by saying: "For most of us, time is a good example of a limited resource. We always have so much we want to do, but a limited amount of time to do it in. We must make choices about the use of our limited time, and other limited resources."

B. Go on, "Imagine that tonight you will have one hour available between supper and bed time. How will you use that time? You could watch T.V., your favorite show is on tonight. You could spend the time finishing a book report. It's due the day after tomorrow. These are your choices."

C. Diagram the situation described in Step B on the chalkboard, as follows:



D.. Then say "Decisions have costs that go along with them that are not measured in dollars. These kinds of costs refer to the next best opportunity that is passed up when one choice is taken instead of another. These costs are called opportunity costs.

E. "Let's say you choose to watch your favorite program. What is the opportunity cost of making that choice? You pass up an opportunity to finish your book report. So the opportunity cost of watching T.V. tonight is not finishing your book report.

F. Ask "What is the opportunity cost involved in choosing to finish your book report?" Students should respond, "Well, I give up the opportunity to watch my favorite T.V. program. So the opportunity cost of finishing my report is not being able to watch T.V."

G. Distribute the student handout "Opportunity Costs." Have students read the directions for Part A. Review the directions as a group. Then have students complete Part A.

H. Review student answers to the questions posed in Part A of the handout. They should respond:

Situation One:
- i) Mark's time is the limited resource.
- ii) (Student's choice)
- iii) If student picks baby sitting, then the opportunity cost is not being able to go out with friends. If the student picks going out with friends, then the opportunity cost is not baby sitting.

Situation Two:
- i) Tina's paycheck is the limited resource.
- ii) (Student's choice)
- iii) If student picks new record album, then the opportunity cost is not being able to buy a new shirt. If student picks new shirt, the opportunity cost is not being able to buy a new record album.

NOTE: Point out that in this case a money cost -- the price of the shirt or record -- as well as an opportunity cost was involved.

Situation Three:
- i) Space in Bill's yard is the limited resource.
- ii) (Student's choice)
- iii) If student chooses to grow tomatoes, then the opportunity cost is not being able to grow green peppers. If the student picks green peppers, then the opportunity cost is not being able to grow tomatoes.

I. Complete this portion of the lesson by reviewing the meaning of opportunity costs as follows: (You may want to write these points on the chalkboard.)

i) We must make choices about the use of our limited resources.
ii) When one thing is chosen over another, there is sometimes a money cost involved.
iii) There is always an opportunity cost involved.
iv) An opportunity cost is not measured in dollars and cents.
v) It is the next best opportunity that is given up when one thing is chosen instead of another.

J. To begin the second part of the lesson say "Consumers are often faced with making choices. Some of these choices have to do with energy. Here's an example.

"Let's suppose that the price of electricity increases. If this happens most consumers will try to reduce or cut down on the amount of electricity they use." Then ask "How can a consumer cut down on the amount of electricity she uses in her home?" Record student responses on the chalkboard. They might respond:

- By turning out lights;
- By using certain electric appliances less (e.g. fewer hours of T.V., etc.);
- If she has an electric furnace, she could turn the thermostat down;
- She could insulate her electric water heater;
- She could use some appliances differently (e.g., open dishwasher door to dry dishes).

Some students might mention that she could turn to a substitute. If she heated her home with electricity, she might replace her electric furnace with one that uses natural gas.

K. "There are a lot of ways to reduce the amount of electricity used in the home. But before any of these ways are used some choice must be made, like:

- Should we start turning off the lights all the time or should we go on as we are?
- Should we buy an "old fashioned" hand operated can opener or keep using our electric one?"

"Let's imagine that a consumer is faced with making one of these kinds of choices: She examines the family budget very carefully and finds 500 dollars that could be used to buy one of those new energy-efficient refrigerators that uses only a little electricity to operate.

"She figures that electricity prices will keep going up so by spending some money now for an energy efficient refrigerator, the family will save a lot of money in the future on the electric bills.

"Then she starts wondering 'Do I go down to the appliance store and buy a new refrigerator or should I spend $500 to get my teeth fixed? These cavities are killing me!'

"Let's say she decides to go ahead and buy the energy efficient refrigerator. What are her money costs?" (Student response - $500). "What is her opportunity cost?" (She gives up an opportunity to get her teeth fixed - so the opportunity cost of buying the refrigerator is not getting her teeth fixed.)

L. Have students read directions for Part B of the handout, "Opportunity Costs." Review the directions as a group. Then have students complete Part B. Encourage them to use their imaginations.

M. Review student responses to the questions asked in Part B as a class. Many answers are possible. Be sure, however, that they represent opportunities foreclosed by the decision made in each case. Some possibilities:

a) Giving up comfort of cool temperatures in your house;
b) Giving up the opportunity to move around the city on your own schedule; what could you do with the time spent waiting?
c) Other things you could have done with your time and money;
d) Giving up your old friends and familiar neighborhood:
e) Giving up spare time that you spent to buy and operate a large refrigerator needed to store all that perishable food.

NOTE TO TEACHER: Students might argue that there is more than one alternate way of using each of the limited resources described in these situations. You should point out that opportunity costs refer to the next best use to which the resources can be put.

N. To end this lesson, remind students that when consumers make decisions they must consider the costs as well as the benefits that go along with those decisions. Point out in closing that when costs are estimated, money costs are often important. But opportunity costs - the next best opportunity that must be given up when a particular decision is made - must always be considered.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define opportunity costs. Have them give an example from their own experience.

2. Develop a series of short energy-saving decision statements similar to those contained in Part B of the student worksheet. Have students describe an opportunity cost associated with each decision. Here are some possible statements:

   a) Deciding to reduce the amount of natural gas used by turning down the thermostat in your home;
   b) Deciding to reduce the amount of gasoline used by getting your car tuned.

SPIN OFF

The U.S. Department of Energy published a free pamphlet entitled "Tips for Energy Savers." Single copies can be obtained by writing:

"Tips for Energy Savers"
Pueblo, CO 81009

In the pamphlet are hundreds of suggestions for reducing energy consumption. These suggestions are grouped under three headings: (1) In and Around the Home, (2) On the Road, (3) In the Market Place.

Have students examine the suggestions in the pamphlet. Assign them the task of describing opportunity costs associated with these suggestions.

OPPORTUNITY COSTS

Part A: Shown below are choices faced by different people. In each case (i) identify the limited resource described, (ii) identify the choice that you would pick and (iii) state the opportunity cost involved in making that choice. Use the space provided for your answers.

Situation One: Mark can babysit on Saturday night or go out with friends.

i) What limited resource is described here?____________
ii) Which choice would you pick?________________________
iii) What is the opportunity cost involved in making the choice?____

____

Situation Two: Tina can spend her paycheck received for delivering newspapers to buy a new record album or a new shirt.

i) What limited resource is described here?____________
ii) Which choice would you pick?________________________
iii) What is the opportunity cost involved in making that choice?____

____

Situation Three: Bill grows vegetables in a small garden behind his house. He has enough space left to plant either tomatoes or green peppers.

i) What limited resource is described here?____________
ii) Which choice would you pick?________________________
iii) What is the opportunity cost involved in making the choice?____

____

Part B: Listed below are 5 decisions that you could make to reduce energy use. There are benefits (in terms of possible future savings) that go along with each. Some decisions have money costs that go along with them. Your job, however, is to consider only opportunity costs. Write down, in the space provided, an opportunity cost that would go along with each of these decisions. Many different answers are possible.

a. Saving energy by turning down the thermostat on your air conditioner__________________________________

b. Deciding to reduce the amount of gasoline used by taking the bus____________________________________

c. Deciding to reduce the amount of heating oil used by spending the weekend caulking and weather stripping your home______________________________________

d. Deciding to reduce the amount of gasoline used by moving to a home nearer the place where you work

____

e. Saving gasoline by doing all your grocery shopping in one weekly trip______________________________

LESSON 7: HOW MANY SHOULD WE BUY?

CONCEPTS: Demand, price mechanism

RECOMMENDED USE: Middle school

TIME REQUIRED: 1-2 class periods

MATERIALS REQUIRED:
One apple
Student handout "My Demand Schedule"
Transparency "Class Demand"
Student handout "Demand for Gasoline in Hoosierland"
Student handout "Scenes at a Hoosierland Service Station"
Blackline masters provided.

RATIONALE:

The concepts of supply and demand are extremely helpful in understanding energy issues. Unfortunately, the concepts are often used in a confusing manner by writers and speakers. It is therefore important that students learn the correct definitions of these concepts and their accurate application to energy use. The purpose of this lesson is to clarify the concept demand.

The demand for a good refers to the amount of that good that consumers are willing and able to purchase at various possible prices, other things being equal, during some particular period of time. The lower the price, the more will be demanded and vice versa.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. define demand;
2. describe the relation between prices and the quantity demanded.

SUGGESTED TEACHING PROCEDURE:

A. Begin this lesson by showing the apple to the students. Describe it (weight, variety) and let students examine it. Then say "Raise your hand if you would buy apples like this one."

B. Distribute handout "My Demand Schedule". Explain that in the column labeled "Amount I Would Buy" students should write the number of apples they would be both willing and able to buy at each price, today. (Note: you might need to explain that "willing" means you would like to buy something; "able" means you have the money to buy something.)

C. Point out that someone who is willing and able to buy two apples at 30 cents each would be willing and able to buy at least two apples (and maybe more) at 25 cents each. Then, for each price in turn, ask: "How many apples would you be willing and able to buy if apples were ______ cents each?" Have students write the amount they would buy on their schedules.

D. After students complete the handout, project transparency "Class Demand Schedule". Have students raise their hands with fingers extended to show the number of apples they would be willing and able to buy at each price as you announce it. Write the total amount demanded on the appropriate line of the class schedule. (There may be prices at which no apples are demanded)

E. Point out that the schedule just created shows the demand for apples, today. Demand refers to the amount of something, in this case apples, that other people (you students) are willing and able to buy at various prices, other things being equal. Ask "How many apples would this class be willing and able to buy if they sold at 50 cents each? How about 1 cent each?"

F. Project transparency "Class Demand Graph". Select students to plot the data on class demand as points on the chart. Then connect the points.

G. Ask the following questions about the line graph created in Step F. (Note: This might be a good opportunity for you to introduce some of the features of line graphs.)

   a. How many apples was the class willing and able to buy at 25 cents per apple?

   b. At what price was the class willing and able to buy ________ apples?

   c. As the price of each apple went up, what happened to the number of apples the class was willing and able to buy? (Student response - it went down.)

d. As the price of each apple went down, what happened to the number of apples the class was willing and able to buy? (Student response - it went up.)

e. What general statement can you make about how the price of apples affected the number of apples the class was willing and able to buy? (Students might respond: As price goes up the number of apples the class was willing and able to buy went down and vice versa.)

H. You might want to have students create a second demand schedule and graph (using the procedures described above) for an item that most students value more than apples--like candy bars or "twinkies." This will give students an idea of how the amount of a good demanded at various prices depends on the nature of that good.

I. Distribute handout "Demand for Gasoline in Hoosierland." Point out that the information on the handout *is* fictional *but* it is realistic.

J. Have students follow the directions in Part A of the handout. They should respond: Demand refers to the (*amount*) of a product, in this case (*gasoline*), that people are willing and (*able*) to buy at various (*prices*). The table says that if gasoline was offered for sale at $2.00 a gallon, the amount demanded would be (*20,000*) gallons. If the price was (*$1.00*), the amount demanded would be 40,000 gallons.

K. Have students answer the questions in Part B of the handout. They should respond:

a) 50,000 gallons
b) $1.25 a gallon
c) It went down.
d) It went up.
e) possible response: As price goes up the number of gallons of gasoline demanded goes down, and vice versa.

L. Conclude this lesson by pointing out that the demand for a good - whether it be apples or gasoline - refers to the amount of that good that people are both *willing* and *able* to buy at various prices, *other things being equal*, during some particular period of time. Point out further that price has an important effect on the amount demanded. The higher the price, the less will be the amount demanded.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define demand.
2. Have students describe in writing or using diagrams how the amount demanded changes with change in price.

SPIN OFF

In this lesson students were introduced to the concept of demand. They learned about the relation between price and the amount demanded. To extend this lesson, have them respond to the situations described on the handout "Scenes at a Hoosierland Service Station."

NOTE: A shortage is described in the first situation, a surplus in the second.

NOTE: This lesson is intended as background for three lessons:

"Supply, Demand and Prices in the Energy Market"
"Changes in Supply and Demand"
"Price Ceilings"

STUDENT HANDOUT

MY DEMAND SCHEDULE

Today's Date ________________

PRICE PER APPLE	AMOUNT I WOULD BE WILLING AND ABLE TO BUY
50¢	____________
45¢	____________
40¢	____________
35¢	____________
30¢	____________
25¢	____________
20¢	____________
15¢	____________
10¢	____________
5¢	____________
1¢	____________

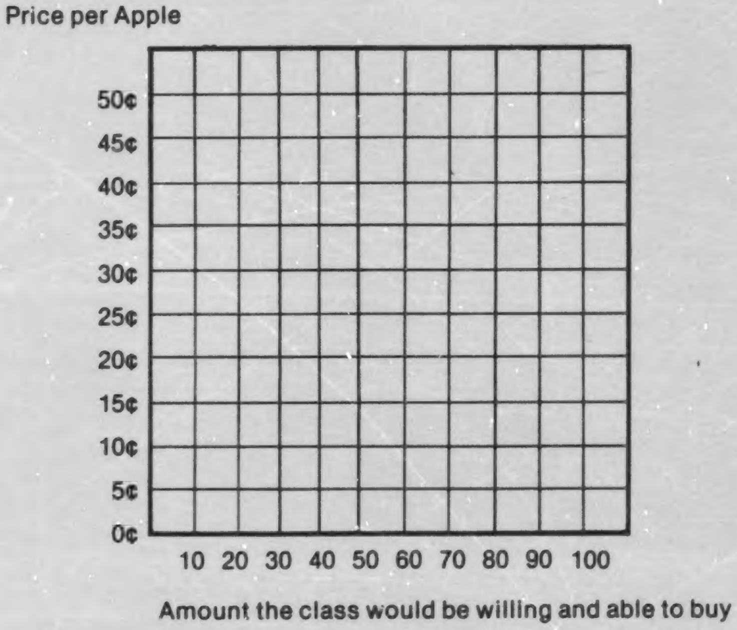
TRANSPARENCY MASTER

CLASS DEMAND

TODAY'S DATE ____________________

Price per Apple	Amount the class would be willing and able to buy.
50¢	________
45¢	________
40¢	________
35¢	________
30¢	________
25¢	________
20¢	________
15¢	________
10¢	________
5¢	________
1¢	________

TODAY'S DATE ____________________



STUDENT HANDOUT

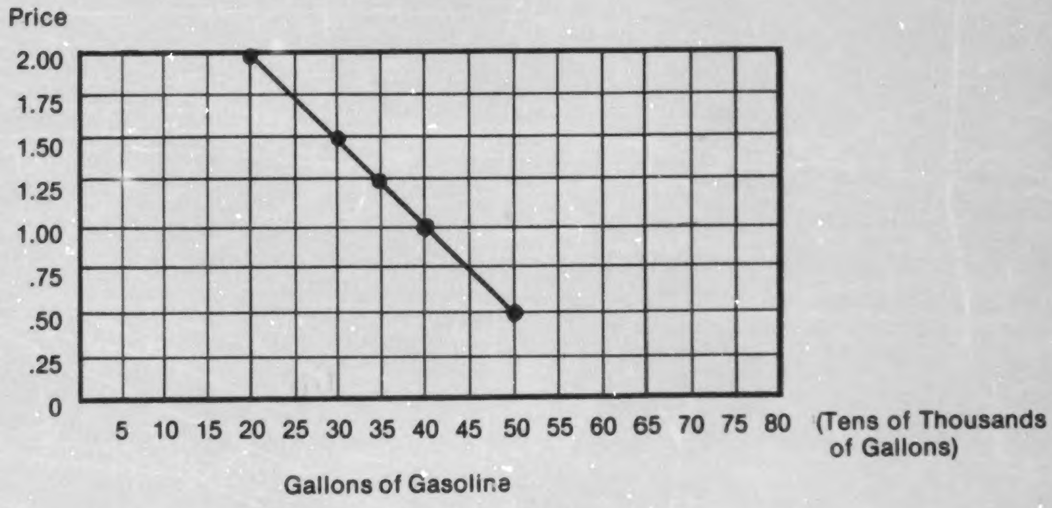
DEMAND FOR GASOLINE IN HOOSIERLAND
JANUARY 1, 1983

PRICE (PER GALLON)	AMOUNT DEMANDED (PER GALLON)
$2.00	20,000
1.50	30,000
1.25	35,000
1.00	40,000
.50	50,000

PART A: Fill in the blanks in the following sentences. Use the information above to help you. Also use what you know about demand.

The table above shows the demand for gasoline in Hoosierland on January 1, 1983. Demand refers to the ______ of a product, in this case __________, that people are willing and __________ to buy at various ___________. The table says that if gasoline was offered for sale at $2.00 a gallon, the amount demanded would be ________ gallons. If the price was _________, the amount demanded would be 40,000 gallons.

DEMAND FOR GASOLINE IN HOOSIERLAND
JANUARY 1, 1983



Part B: Answer the following questions in the space provided: Use the information in the graph to help you.

a) How many gallons of gasoline would be demanded if the price was $.50 a gallon?____________________

b) At what price would 35,000 gallons of gasoline be demanded?____________________

c) As the price of each gallon went up, what happened to the number of gallons demanded?____________________
____

d) As the price of each gallon went down, what happened to the number of gallons demanded?____________________
____

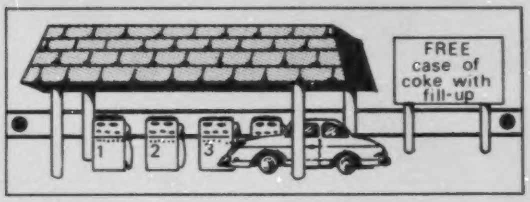
e) What general statement can you make about how the price of gasoline affected the number of gallons demanded?
____
____

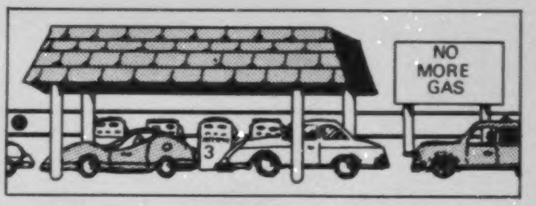
SCENES AT A HOOSIERLAND SERVICE STATION

Demand for Gasoline in Hoosierland
January 1, 1983

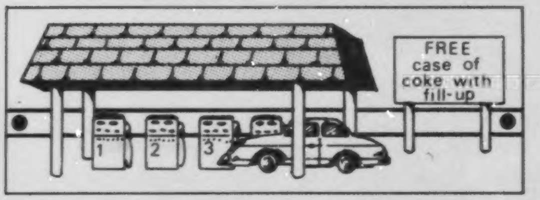
Price (per gallon)	Amount Demanded (per gallon)
$2.00	20,000
1.50	30,000
1.25	35,000
1.00	40,000
.50	50,000

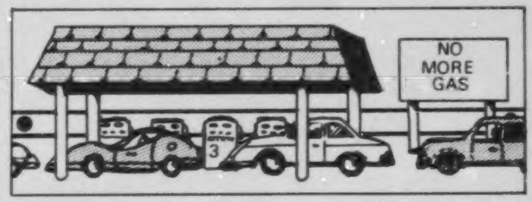
Situation One: On January 1, 1983, the price of gasoline in Hoosierland is set at $1.00 a gallon. At that price, service station owners offer 30,000 gallons of gasoline for sale. How many gallons would be demanded at that price? ________. Look at the following pictures. Which would better describe the scene at a service station in Hoosierland after gasoline had been selling for $1.00 a gallon for a while?


FREE case of coke with fill-up
1
2
3



Situation Two: On January 1, 1983, the price of gasoline in Hoosierland is set at $1.50 a gallon. At that price, service station owners offer 40,000 gallons of gasoline for sale. How many gallons would be demanded at that price?________. Look at the following pictures. Which would better describe the scene at a service station in Hoosierland after gasoline had been selling for $1.50 a gallon for a while?


FREE case of coke with fill-up
1
2
3



LESSON 8: SUPPLY, DEMAND AND PRICES IN THE ENERGY MARKET

CONCEPTS: Market, supply, demand, market clearing price

RECOMMENDED USE: Middle school

TIME REQUIRED: 2-3 class periods

MATERIAL REQUIRED: Student materials, included
Student worksheets:
1. "Supply and Demand"
2. "Scenes at a Hoosierland Gasoline Station"
Blackline masters of these worksheets are included.

ECONOMICS IN THIS LESSON:

In the American economy individual buyers and sellers register their decisions to buy or sell goods, services and productive resources in the market. The market "adds up" these individual decisions to buy and sell and creates out of them aggregate forces known as supply and demand.

Supply and demand constitute the sum total of all the individual decisions to sell and to buy in the market. Interacting with one another, the price of what is bought and sold is determined.

Supply indicates the amounts of anything that will be offered for sale at various possible prices during some period of time, other things constant. Generally, the higher the price of something, the more it will be produced and offered for sale and vice versa.

Demand reflects the amounts that consumers will be willing and able to buy at various possible prices during the same time period, other things constant. Typically, the lower the price, the more will be demanded and vice versa.

In the market, supply and demand working together determine a market clearing price. At this price the amount demanded and the amount supplied are equal.

RATIONALE:

The concepts of supply, demand and market clearing price are useful when analyzing the economic actions involved in energy use. Unfortunately, these concepts are often used in a confusing manner by writers and speakers. It is therefore important that students learn the correct definitions of these concepts and their accurate application to energy use. Clarifying these terms and using them correctly is the purpose of this lesson.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. define supply, demand and market clearing price;
2. describe the relation between prices and the quantities supplied and demanded;
3. describe how price changes affect the decisions made by producers and consumers.

SUGGESTED TEACHING PROCEDURE:

NOTE: An effort is made in this lesson to make an abstract set of ideas - the working of a market economy - concrete for students. Thus, a survey like the one described in the lesson is not really held to determine level of supply and demand. Estimates are made *as if* a survey of individual consumers and producers was held and their responses were added together, however.

One of your tasks in this lesson will be to periodically remind students that they will get a good sense of how the "real world" works in terms of supply and demand by working with the imaginary material in this lesson. Several suggestions for connecting the lesson with real world events are made in this teacher's guide.

A. You may decide to present the material contained in paragraphs 1-3 (including Table One) to the students orally. It is important for students to realize that consumers were asked how much gasoline they would be *willing* and *able* to purchase on the day of the survey and that individual answers were added together to produce the demand figures seen in Table One.

NOTE: In reality, of course, demand is never as accurately computed as it is here. Nevertheless, it represents the sum of individual consumers' decisions. In the same way supply represents the sum of individual producers' decisions.

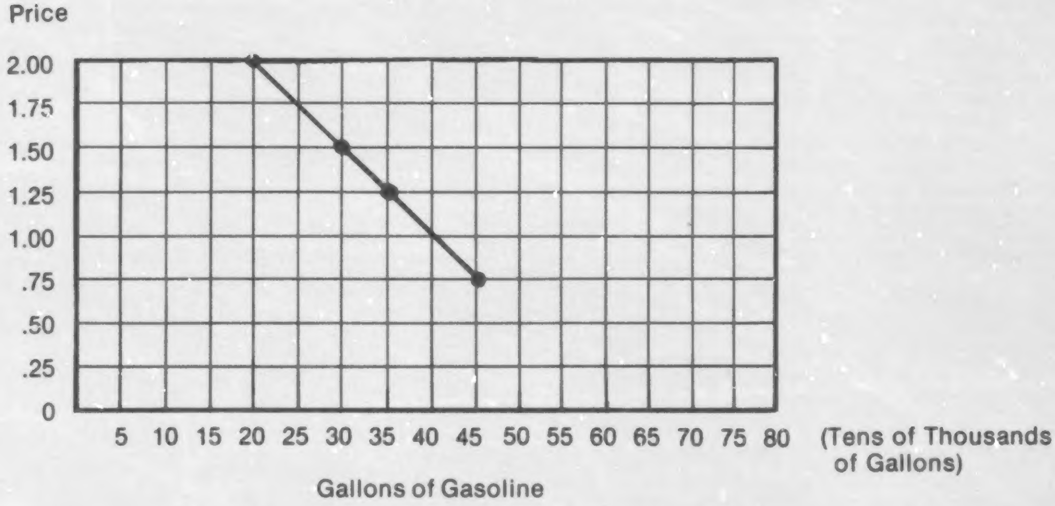
B. Have students read paragraph 4 and review the characteristics of demand as a group:

The amount of a product consumers are *willing* and *able* to purchase at various possible prices during a period of time.

C. NOTE: Certain factors determine the amount of a product, like gasoline, that consumers are willing and able to purchase at various prices. These factors, called determinants of demand, like consumers' income and taste, are subject to change. The amounts demanded at various prices will also change. In this lesson a specific date is always used when discussing demand. This has the effect of holding these determinants of demand constant. (They probably won't change in one day). This allows students to observe the effects of changes in price on the amount demanded without worrying about "other things constant." (The lesson "Changes in Supply and Demand" examines the determinants of demand and supply).

D. Hand out the worksheet "Supply and Demand." Have students follow the directions in paragraph 5. Their graphs should look like this:

FIGURE A: DEMAND FOR GASOLINE, HOOSIERLAND
April 1, 1978

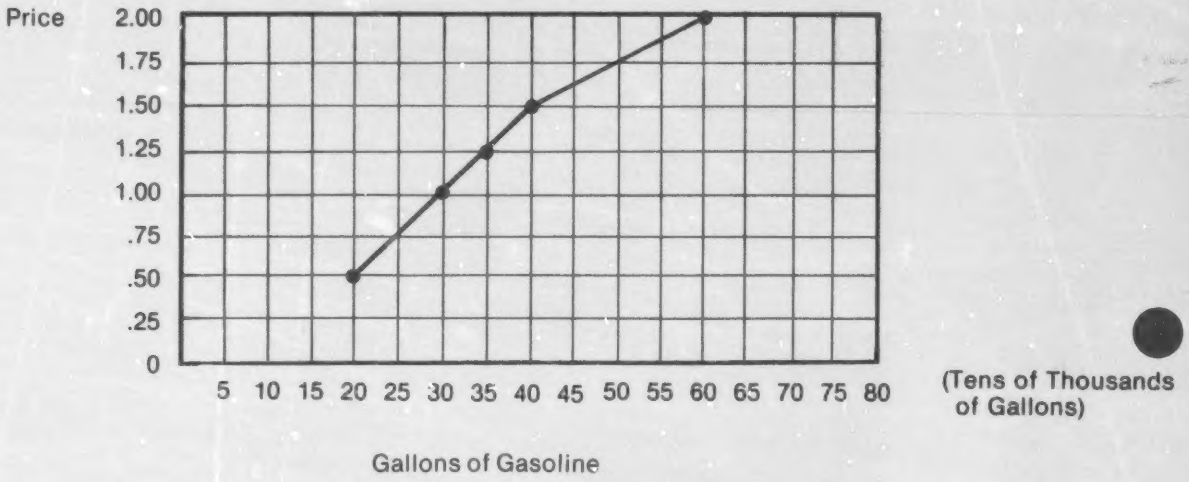


E. After students have completed their demand line-graphs, have them answer the question in paragraph 6. They should respond "C, the amount of gasoline demanded decreases as the price increases."

F. To complete this section of the lesson, point out that what is true of Hoosierland is true elsewhere - certainly in this country. It is also true for most products. Consumers will buy less of a product at a higher price than they will at a lower price, other things constant.

G. The next section of this lesson deals with supply. It is covered in paragraphs 8 to 13 of the student materials. Use the procedure suggested in Steps A-F above to cover this material. Students are asked to construct a line graph in paragraph 11. They use the worksheet "Supply and Demand". Their graphs should look like this:

FIGURE B: SUPPLY OF GASOLINE, HOOSIERLAND, April 1, 1978



Their answer to the question asked in paragraph 12 should be "A - As price increases, the amount of gasoline supplied also increases."

H. NOTE: Certain factors determine the amount of a product, like gasoline, that suppliers are willing and able to offer for sale, at various prices. These factors, called determinants of supply - like the price of resources and the number of producers - are subject to change. When they change, the amount supplied at various prices will also change. In this lesson a specific date is always used when discussing supply. This has the effect of holding these determinants of supply constant. This allows students to observe the effects of change in price on the amount supplied without worrying about "other things constant." (The lesson "Changes in Supply and Demand" examines the determinants of supply and demand.)

I. Conclude the section on supply and demand by pointing out that what is true of Hoosierland is also true elsewhere in the U.S. It is also true for most products. Producers will provide more of a product for sale at a higher price than they will at a lower price, other things constant.

J. Paragraph 14 reviews what students have learned about the needs of Hoosierland consumers and producers. Basically their needs oppose each other.

You might point out that what is true of Hoosierland is true of the U.S. and what is true of gasoline is true of almost all products. Producers are willing and able to offer more at high prices. Consumers are willing and able to purchase more at low prices.

K. Then point out that in the U.S., as well as in Hoosierland, questions such as what price is charged, how much is produced, how much is purchased and who gets what is produced are answered in a market situation. (Paragraphs 15 and 16).

L. Have students read paragraphs 17 and 18. Point out that the graph in Figure C shows the market situation for gasoline in Hoosierland for one moment in time. In the graph the demands of the consumers are allowed to interact with the supplies offered by the producers.

NOTE: A similar graph could be used to show the interaction of supply and demand for nearly any product available in the U.S.

M. Have students read paragraphs 19-21. Review these paragraphs as a class.

a) There is one price - $1.25 - where the supply and demand lines intersect and the quantity demanded equals the quantity supplied.
b) This price is called the market clearing price because...
c) all gasoline offered for sale at that price would be purchased.

NOTE: Some students may have trouble understanding why 35,000 gallons would be both demanded and supplied at $1.25. If they do, have them look back to Figures 4 and 10 to examine supply and demand separately at the $1.25 price.

N. Point out that under normal conditions the price of products tends to move towards the market clearing price. (NOTE: One exception in the U.S. economy occurs when the government imposes a price control below the market clearing price. This topic is examined in the lesson "Price Ceilings.")

O. Once the price of a product is established in a market situation, the amount of that product that will be produced and purchased is also established. (Paragraph 22)

P. A new idea is introduced in paragraph 23. Price has a rationing effect. It determines who will purchase a product. Have students read this paragraph carefully. Be sure they understand that price plays a rationing role.

Q. With the information contained in paragraph 23 as background, have students follow the directions in paragraph 24. Accept all reasonable suggestions. You might want to distinguish between short range (SR) options - things that people can do immediately - and long range (LR) options that they can implement over a longer period of time. Students might respond:

a) The consumer could do without gasoline (SR).
b) The consumer could use a lot less gasoline by using his/her car less (SR).
c) The consumer might start walking or taking the bus (SR).
d) Purchase a fuel efficient car (LR).
e) Move closer to job, schools, shopping (LR).
f) Political action to increase/improve public transportation (LR).

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define supply, demand and market clearing price.

2. Provide students with information about various energy products similar to that contained in Table One and Two. Then have them:

   a) construct line graphs;
   b) state in words the trends shown in the line graphs.

Here is some information that you can use:

DEMAND FOR ELECTRICITY

Amount Demanded	Price (per Kilowatt hr.)	Amount Supplied
100,000 kilowatt hrs.	1¢	30,000 kilowatt hrs.
90,000	2¢	45,000
70,000	3¢	70,000
50,000	4¢	80,000
45,000	5¢	95,000

3. Use the information in the table above to create a market situation graph (like Figure C). Then:

   a) have students identify the market clearing price;
   b) answer questions about the options available to consumers and producers when the price of electricity changes.

SPIN OFF

In this lesson students have been introduced to the concepts of supply and demand as they interact in the market. They have learned where prices come from and that they usually stabilize near the market clearing price. To extend this lesson, have them respond to the questions on the worksheet, "Scenes at a Hoosierland Gasoline Station."

NOTE: The first situation describes a surplus. You should point out that a sale at a clothing store, an after Christmas sale, a Washington's Birthday sale, etc., are all similar to the way gasoline producers dealt with the surplus (as shown in the picture of prices being lowered). Each of these techniques is used by sellers to find a price where all of their merchandise will be sold to customers. A clearance sale is an attempt to clear the market.

The second situation describes a shortage. In this situation the prices would be going up, encouraging sellers to sell more and consumers to buy less.

STUDENT MATERIALS: SUPPLY, DEMAND AND PRICES IN THE ENERGY MARKET

DEMAND FOR GASOLINE

1. Imagine that an energy survey was held in the fictional country of Hoosierland. The survey was held about 5 years ago. In the survey, energy consumers were shown a chart of different gasoline prices. The chart looked like this:

Price Per Gallon

$2.00
1.50
1.25
1.00
.50

2. Consumers were asked "How much gasoline would you use at each of the prices shown on the chart?" They were asked to tell how much they were willing and able to buy on the day of the survey, April 1, 1978.

3. The answers given by all consumers involved in the survey were added together. The results are shown in Table One.

TABLE ONE: DEMAND FOR GASOLINE, HOOSIERLAND
April 1, 1978

Price (per gallon)	Amount Demanded (in gallons)
$2.00	20,000
1.50	30,000
1.25	35,000
1.00	40,000
.50	50,000

4. Table One shows the demand for gasoline in Hoosierland on the day of the survey. Demand refers to the amount of a product that people are willing and able to purchase at various prices at a certain time. The table says that if gasoline was offered for sale at $2.00 a gallon, the amount demanded would be 20,000 gallons. If the price was $1.00, the amount demanded would be 40,000 gallons.

5. In Figure A on the worksheet "Supply and Demand", gallons of gasoline are shown along the horizontal axis. Price is shown along the vertical axis. Use the information in Table One to construct a line graph on the worksheet.

6. Which one of the following conclusions can be drawn from the demand line that you constructed?

   a) The amount of gasoline demanded does not seem to be affected by price.
   b) As price increases, the amount of gasoline demanded also increases.
   c) The amount of gasoline demanded decreases as the price increases.

7. What is true of Hoosierland is true of the United States. Consumers will buy less of a product at a higher price. They will buy more at a lower price, other things constant.

SUPPLY OF GASOLINE

8. In the survey of April 1, 1978, Hoosierland gasoline producers were also shown the same chart. They were asked "How much gasoline would you offer for sale at each of the prices shown on the chart?" The producers were asked to tell how many they were willing and able to offer for sale, on the day of the survey.

9. The answers given by all producers involved in the survey were added together. The results are shown in Table Two.

TABLE TWO: SUPPLY OF GASOLINE, HOOSIERLAND
April 1, 1978

Price (per gallon)	Amount Supplied (in gallons)
$2.00	60,000
1.50	40,000
1.25	35,000
1.00	30,000
.50	20,000

10. Table Two shows the supply of gasoline in Hoosierland on the day of the survey. Supply refers to the amount of a product that producers are willing and able to offer for sale at various prices, at a certain time. The table says that if gasoline could be offered for sale at $2.00 a gallon, the amount supplied would be 60,000 gallons. If the price was $1.00, the amount supplied would be 30,000 gallons.

11. In Figure B on the worksheet "Supply and Demand," gallons of gasoline are shown along the horizontal axis. Price is shown along the verticle axis. Use the information in Table Two to construct a line graph on the worksheet.

12. Which one of the following conclusions can be drawn from the supply line graph you constructed?

    a) As price increases, the amount of gasoline supplied also increases.
    b) The amount of gasoline supplied does not seem to be affected by price.
    c) The amount of gasoline supplied decreases as the price increases.

13. What is true for Hoosierland is true of the United States. Producers will offer more of a product for sale at a higher price. They will offer less at a lower price, other things constant.

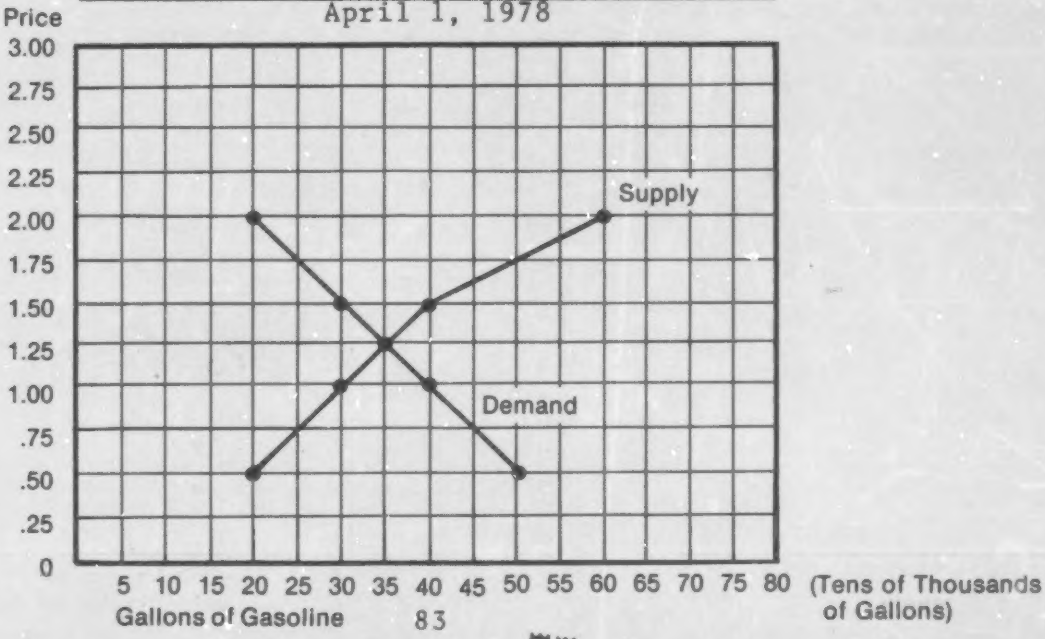
THE ENERGY MARKET

14. Decisions made by consumers and producers in Hoosierland are affected by the same factors. But these factors affect the decisions of consumers and producers in the opposite way! Producers are willing and able to offer more gasoline for sale at high prices. Consumers are willing and able to purchase less gasoline at high prices. Consumers are willing and able to purchase more at low prices. Producers are willing and able to offer less for sale at low prices.

15. The answer is that Hoosierland producers and consumers must make their needs known to each other. This is done in a market.

16. The market for gasoline in Hoosierland can be seen on the following graph. It was made by putting the demand line graph and the supply line graph that you constructed, together.

FIGURE C: MARKET SITUATION, HOOSIERLAND
April 1, 1978



17. The graph in Figure C shows the amount of gasoline that consumers in Hoosierland demanded on April 1, 1978. It also shows the amount of gasoline that Hoosierland producers supplied on that date.

18. At what price will gasoline be bought and sold? There is one point at which the demand line and the supply line intersect. It is at $1.25 a gallon.

19. If the price of gasoline is $1.25 a gallon - 35,000 gallons will be demanded. An equal amount will be supplied. At that price producers will offer for sale the same amount of gasoline as consumers will purchase.

20. $1.25 is the market clearing price, in this situation. All gasoline offered for sale would be purchased at that price.

21. Price determines how much producers are willing and able to offer for sale. It also determines how much consumers are willing and able to purchase.

22. The market clearing price also determines who will purchase the product. If gasoline, for example, is sold at $1.25 a gallon in Hoosierland, 35,000 gallons will be purchased. But it will be purchased only by those consumers who are willing and able to spend $1.25 for a gallon of gas. If the market clearing price increases to $1.50 some consumers will not purchase gasoline. Others will buy less.

23. To end this lesson, list three options that are available to a Hoosierland consumer who is unwilling and/or unable to purchase gasoline at the market clearing price ($1.25).

WORKSHEET

SUPPLY AND DEMAND

FIGURE A: DEMAND FOR GASOLINE, HOOSIERLAND

April 1, 1978

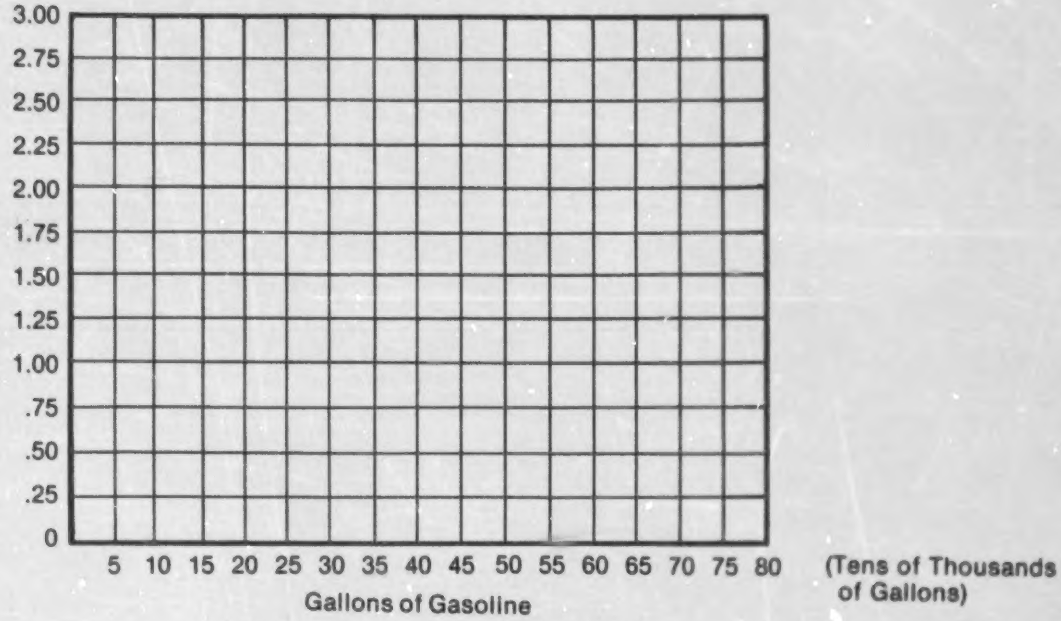
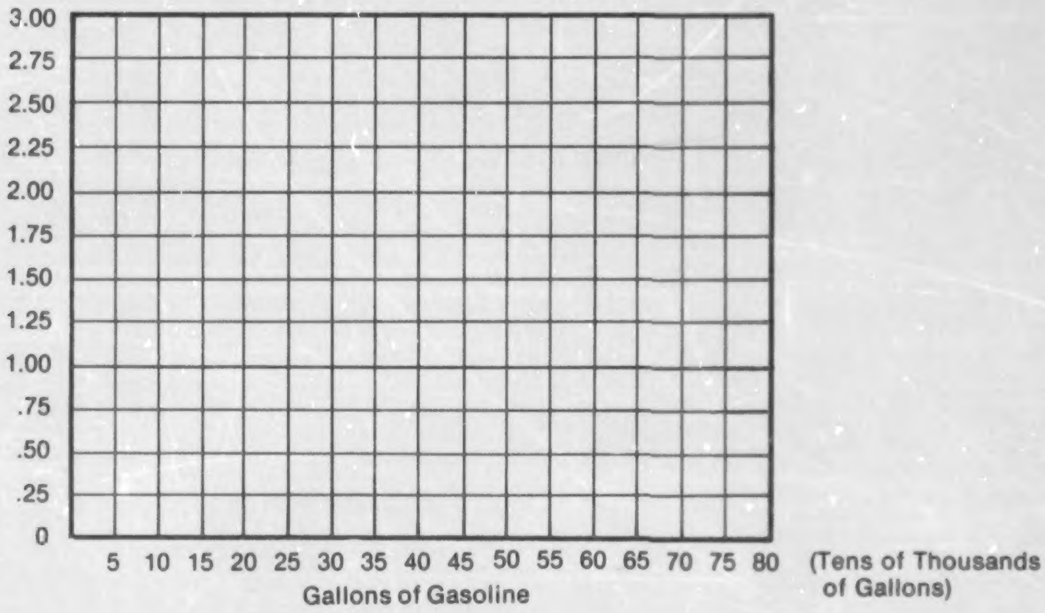


FIGURE B: SUPPLY OF GASOLINE, HOOSIERLAND

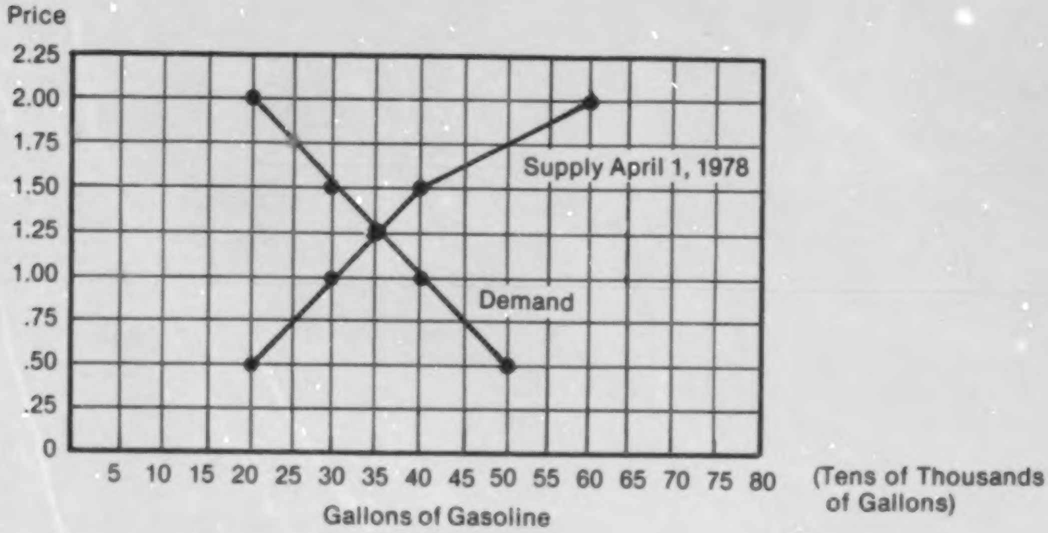
April 1, 1979



WORKSHEET

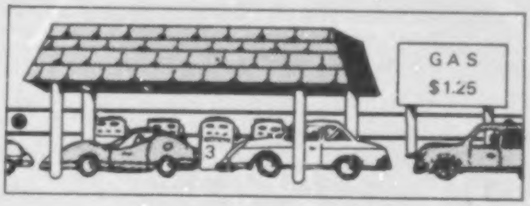
SCENES AT A HOOSIERLAND GASOLINE STATION
MARKET SITUATION, HOOSIERLAND

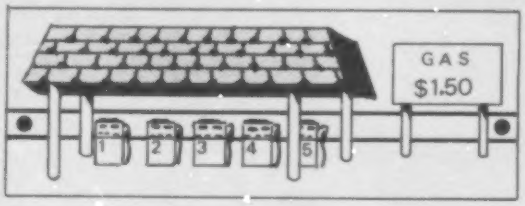
April 1, 1978



Sometimes the price of a product is set above or below the market clearing price. Imagine, for example, that the price of gasoline in Hoosierland was $1.50 per gallon. Use the information in the above figure to answer the following questions:

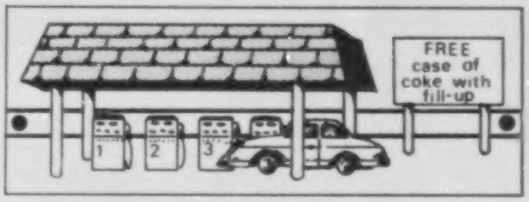
a) How much gasoline would consumers be willing and able to purchase at that price?
b) How much gasoline would producers be willing and able to offer for sale at that price?
c) Does the market clear at that price?
d) Which of the following pictures would better describe the scene around service stations in Hoosierland after gasoline had been selling at $1.50 a gallon for a while?

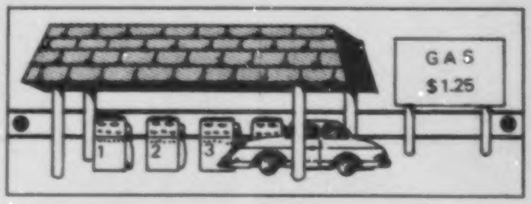




Now imagine that the price of gasoline in Hoosierland is $1.00 per gallon. Use the information in the figure to answer the following questions:

a) How much gasoline would consumers be willing and able to purchase at that price?
b) How much gasoline would producers be willing and able to offer for sale at that price?
c) Does the market clear at this price?
d) Which of the following pictures would better describe the scene around service stations in Hoosierland soon after gasoline started to sell for $1.00 a gallon?


FREE case of coke with fill-up
1
2
3



LESSON 9: CHANGES IN SUPPLY AND DEMAND

CONCEPTS: Determinants of supply and demand; changes in supply and demand

RECOMMENDED USE: Middle school (This lesson deals with advanced concepts. However, it serves as a valuable background for understanding boycotts and their effects on producers and consumers.)

TIME REQUIRED: 2-3 class periods

MATERIAL REQUIRED: Student materials provided

ECONOMICS IN THIS LESSON:

The supply of a good refers to the amount of that good that producers are willing and able to offer for sale at various possible prices, other things constant during some particular period of time.

What determines the amount of a good supplied at various prices? There are five determinants of supply: (1) the price of the factors of production, (2) technology, (3) the price of other goods, (4) the number of producers, and (5) the producers' expectations about the future.

Changes in any of these determinants cause a change in supply. This can be represented by a leftward (decrease) or rightward (increase) shift in the supply curve for a particular period of time.

The demand for a good refers to the amount of that good that consumers are willing and able to purchase at various possible prices, other things constant, during some particular period of time.

What determines the amount of a good demanded at various prices? There are four determinants of demand: (1) the price of other goods, (2) consumer income, (3)consumer tastes and preferences, (4) consumer expectations about the future, and (5) number of buyers.

Changes in any of these determinants cause a change in demand. This can be represented by a leftward (decrease) or rightward (increase) in the supply curve for a particular product.

RATIONALE:

Events occur which change the determinants of supply and demand for a product. This causes supply and demand curves (called "lines" in these lessons) to shift. The result is a change in the market clearing price for that product.

One such event was the decision of OPEC nations to restrict the exports of oil to their customers. This lesson examines an event like the OPEC decision, among others, within a supply-demand context. The lesson shows how such events cause changes in supply and result in higher or lower market prices.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. define "change in supply" and "change in demand;"
2. explain why changes occur in supply and demand;
3. describe how price changes, resulting from changes in supply, affect decisions made by producers and consumers.

SUGGESTED TEACHING PROCEDURE:

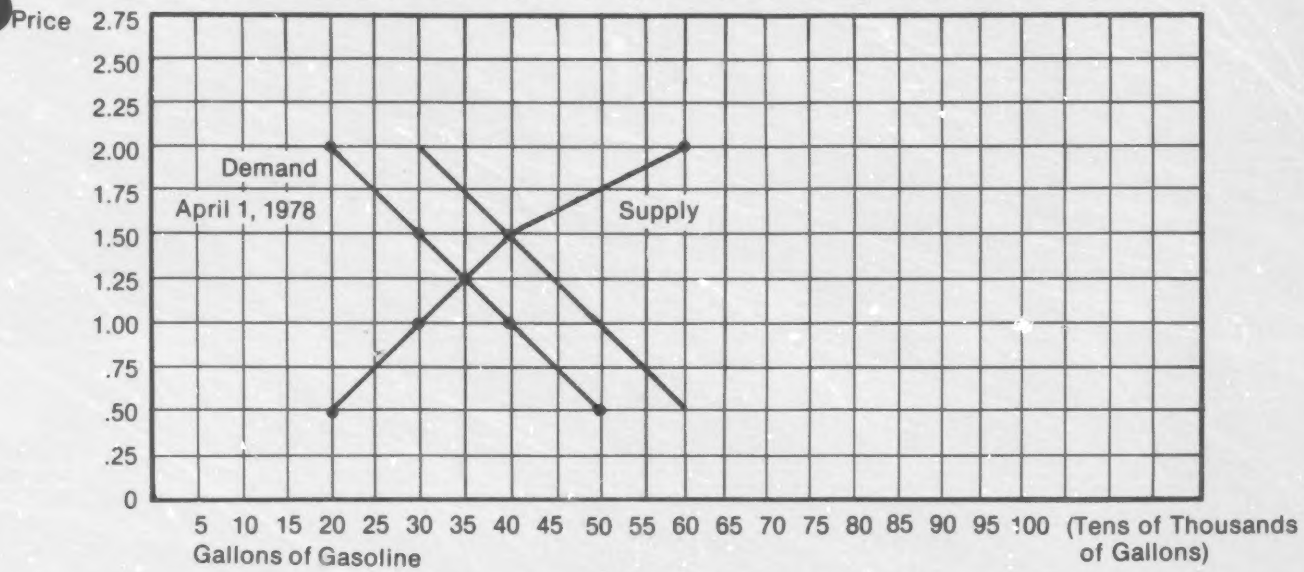
A. If your students have not covered the other lessons in this unit dealing with supply and demand, have students work slowly through paragraphs 1-7 of the student materials. Otherwise, paragraphs 1-7 can serve as a review of the basics of supply, demand, and market clearing price.

B. Have students read paragraphs 8-10 of the student materials. NOTE: At this level it is not important for students to be able to list the determinants of demand or be able to identify these determinants. What is important is that they understand:

   1) that certain factors determine the amount of a good demanded at various prices; (paragraph 8)
   2) that the demand line on a graph or demand information in a table reflects the status of these determinants at one point in time. This point in time is always identified on the table or graph. (paragraph 9)
   3) that these determinants may change at any time. This will cause the amount demanded at various prices to change. (paragraph 10)

C. Have students follow the directions in paragraph 11. Their graph should look like this:

FIGURE B: DEMAND FOR GASOLINE, HOOSIERLAND, JANUARY 20, 1979



D. Point out that the demand line has shifted to the right. Gasoline is a good that people want more of as income increases. Ask students to list other goods that people want more of as their income increases. How about things they want less of as income increases?

E. Ask students how the market clearing price was affected by the upward trend in income. They should respond that it increased as well.

F. Present students with the situation described in paragraph 13. Ask them how the demand line would shift. They should respond - to the left.

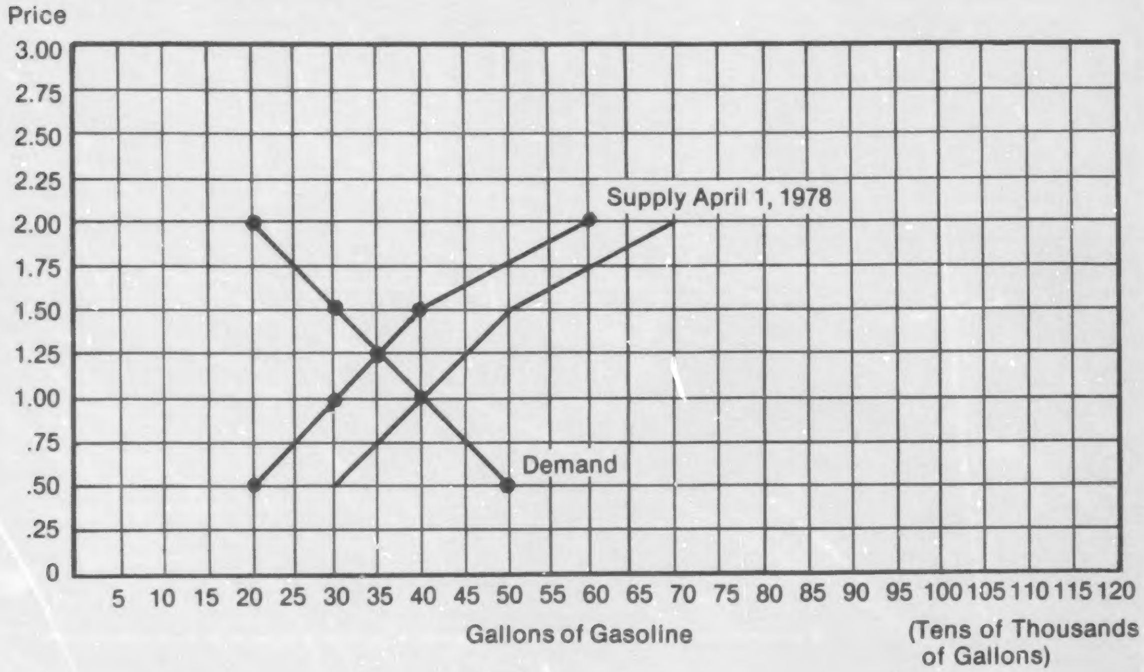
G. Summarize this section by highlighting what is said in paragraph 14.

H. Again, it is not important for students to know exactly which factors determine the amount supplied at various prices. But it is important for them to understand:

1) that there are determinants of supply (paragraph 15);
2) that the supply line on a graph or supply information on a table reflects the status of these determinants at one point in time (paragraph 16);
3) that these determinants and, therefore, the amounts supplied may change at any time (paragraphs 17 and 18).

I. Have students follow the directions in paragraph 19. Their graphs should look like this:

FIGURE C: SUPPLY OF GASOLINE, HOOSIERLAND, MARCH 1, 1979



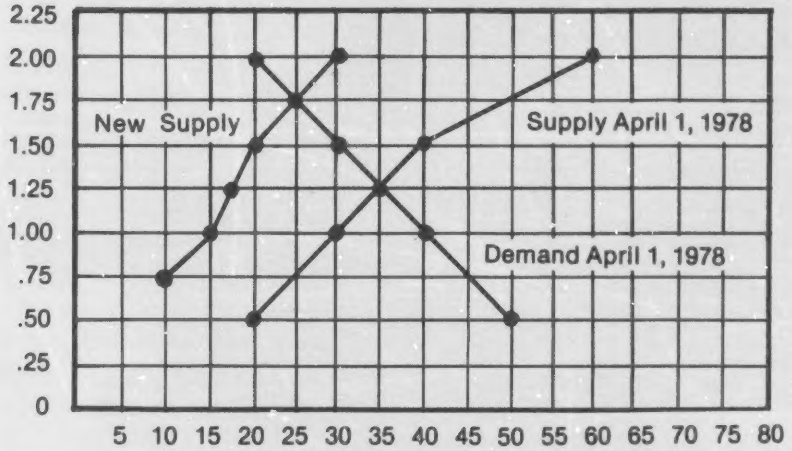
J. Point out that the supply line has shifted to the right. Ask students how the market clearing price was affected when more producers entered the market. They should respond that it went down.

K. Summarize this section by highlighting what is said in paragraph 20.

L. Have students read paragraphs 21-24. You might introduce the final section of this lesson by pointing out that what is described here is a situation similar to the conditions faced by the U.S. in 1973 and 1979 when OPEC drastically reduced exports. You might also mention that the situation described in paragraph 22 - an agreement among independent suppliers to coordinate their supply decisions - is called a cartel. The term cartel is often used to describe the suppliers themselves - as in "OPEC is a cartel" - as well as the agreement among them.

M. Have students follow the directions in paragraph 25. Their graphs should look like this:

FIGURE D: SUPPLY OF GASOLINE, HOOSIERLAND, FEBRUARY 1, 1980



N. Have students answer questions in paragraph 26. They should respond:

a) $1.75 a gallon
b) It shifted to the left.
c) 25,000 gallons
d) They would be encouraged by this higher price to offer more oil, found within Hoosierland, for sale. This might require more exploration and drilling on their part.
e) They might start conserving gasoline by making shorter trips, etc.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define "change in supply" and "change in demand".
2. Show students demand or supply lines on a graph in two different positions. Ask students to explain why the shift occurred. (Accept general answers only).

3. Show students graphs containing information like that they developed in response to the directions in paragraph 25. Then ask a series of questions similar to those in paragraph 26.

SPIN OFF

Students might be interested in exploring what has happened since OPEC reduced exports in 1979 with the consequent increase in prices - as described in the final section of this lesson. Since 1982 news magazines have featured this issue.

Have students begin with the situation described in this lesson - higher oil prices --- change in supply --- higher market clearing price for gasoline. Then have them trace what has happened since to supplies and price, using information contained in news magazine articles. They may be surprised! Here are some good sources:

"OPEC and the Oil Glut: What Happened?" Senior Scholastic, May 14, 1982, pp. 12 - 13.

"Are Lower Prices Good News or Bad News?" U.S. News and World Report, April 5, 1982, p. 42

"Why Prices Are Falling," Newsweek, February 22, 1982, p. 59

"Plunging Petroleum Prices," Time, February 22, 1982, p. 43

"Down, Down, Down," Time, March 15, 1982, pp. 60-62.

STUDENT MATERIALS: CHANGES IN SUPPLY AND DEMAND

1. Below is a table showing information about gasoline supply and demand. The information is for the fictional country of Hoosierland, about 5 years ago.

TABLE ONE: DEMAND FOR GASOLINE, HOOSIERLAND
April 1, 1978

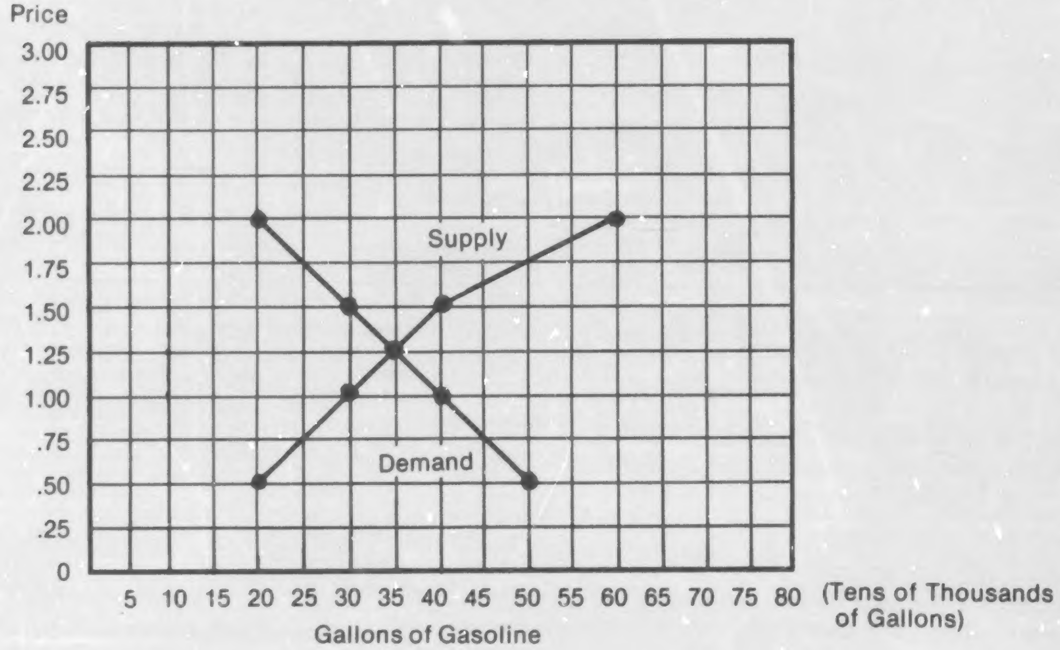
(A) Amount Supplied (in gallons)	(B) Price (per gallon)	(C) Amount Demanded (in gallons)
60,000	$2.00	20,000
40,000	1.50	30,000
35,000	1.25	35,000
30,000	1.00	40,000
20,000	.50	50,000

2. Column "C" shows the demand for gasoline in Hoosierland on April 1, 1978. Demand refers to the amount of a product that people are willing and able to purchase at various prices. Column "A" shows the supply of gasoline in Hoosierland on April 1, 1978. Supply refers to the amount of a product that producers are willing and able to offer for sale at various prices.

3. The table says that if gasoline could be offered for sale at $2.00 a gallon, 60,000 gallons would be supplied. At that price 20,000 gallons would be demanded. How much gasoline would be demanded if the price was $1.00 a gallon? How much would be supplied at that price?

4. The information in Table One is shown in graphic form in Figure A, below.

FIGURE A: DEMAND FOR GASOLINE, HOOSIERLAND, APRIL 1, 1978



5. At what price will gasoline be bought and sold in the situation shown on the graph? You will notice that there is one point at which the demand line and the supply line intersect. It is at $1.25 a gallon.

6. If the price of gasoline is $1.25 a gallon, 35,000 gallons will be demanded and supplied. At that price producers are willing and able to offer for sale the same amount of gasoline as consumers are willing and able to purchase.

7. One dollar and twenty-five cents ($1.25) is the market clearing price. All gasoline offered for sale would be purchased at that price. Usually, a product's price will move toward the market clearing price.

CHANGES IN DEMAND

8. Certain factors determine the amount of a product that consumers are willing and able to purchase at various prices. These determinants of demand are:

   i) the price of other products
   ii) consumer income
   iii) consumer tastes
   iv) consumer hopes for the future
   v) number of consumers

9. So, the amount of gasoline demanded at various prices in Hoosierland on April 1, 1978 (seen in Table One and Figure A) was affected by many things. One was the price being charged for other products - like food and clothing. The amount demanded at various prices was also affected by Hoosierlanders' incomes. Finally, tastes, hopes for the future and the number of consumers in Hoosierland affected the amount of gasoline demanded at various prices on that day.

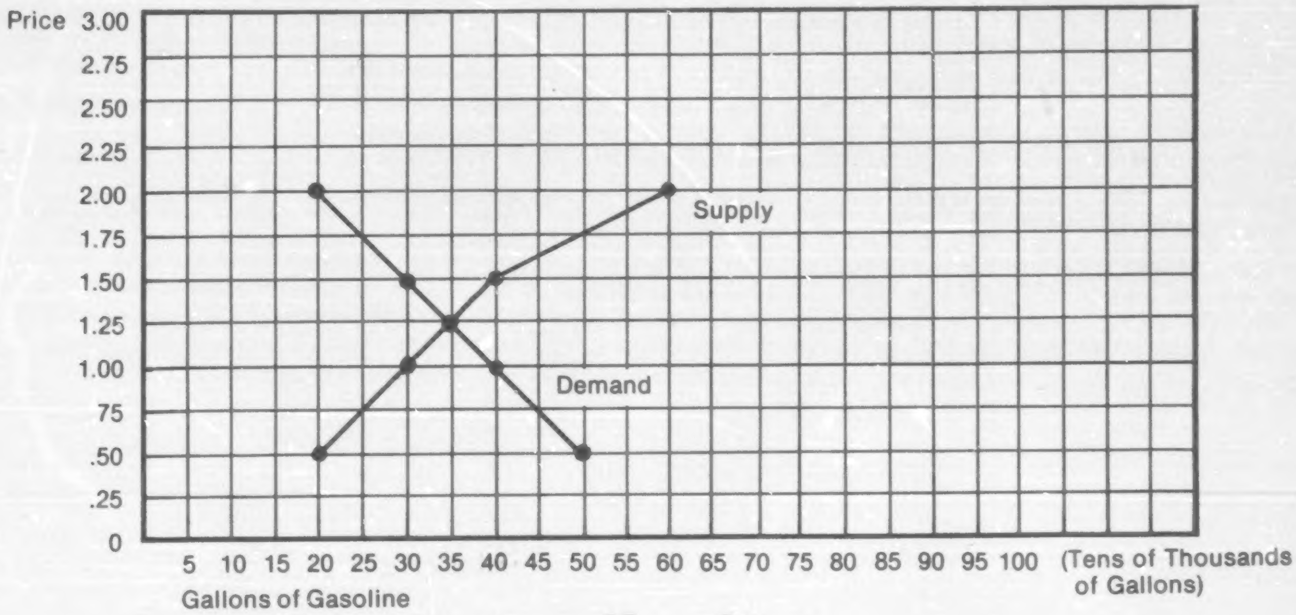
10. If any of these determinants change, the information in Table One, column "C" would change. Imagine, for example, that Hoosierlanders' incomes went up in 1979. What would happen? Well, when people have more money to spend, they usually buy more gasoline. This is true for cheap gas, middle price gas, and expensive gas. In 1979 Hoosierlanders had more money to spend so they probably bought more gasoline than in 1978. Table Two shows the results.

TABLE TWO: DEMAND FOR GASOLINE, HOOSIERLAND
January 20, 1979

Price (per gallon)	Amount Demanded (in gallons)
$2.00	30,000
1.50	40,000
1.25	45,000
1.00	50,000
.50	60,000

11. Use the information in Table Two to construct a demand line on Figure B below for January 20, 1979.

FIGURE B: DEMAND FOR GASOLINE, HOOSIERLAND, JANUARY 20, 1979



12. Notice the position of the demand line. It shifted to the right (increased) when income level increased. Gasoline is the kind of good that people buy more of when their incomes increase.

13. Imagine that in the summer of 1979 tastes of Hoosierlanders began to change. Instead of using their cars to travel everywhere, they started walking and using bikes. As a result by early 1980, they demanded less gasoline at any given price than they did in 1978. In which direction would the demand line shift - to the right or to the left?

14. A shift in the position of the demand line is called a change in demand. They occur when any one or more of the determinants of demand change.

CHANGES IN SUPPLY

15. Certain factors determine the amount of a product that producers are willing and able to offer for sale at various prices. These determinants of supply are:

    i) the prices of resources and other factors of production;
    ii) technology;
    iii) the price of other products;
    iv) the number of producers;
    v) the producers' hopes for the future.

16. So the amount of gasoline at various prices in Hoosierland on April 1, 1978 reflects (1) the prices of resources and other factors of production, (2) the technology, (3) the prices of other products, (4) the number of gasoline producers and (5) the hopes of gasoline producers as they existed on that day in Hoosierland. The results are seen in Table One and Figure A.

17. If any of these determinants change, the information in Table One, column "A" would also change. Imagine for example, that on April 1, 1978 there were 10 gasoline producers in Hoosierland. Adding together the amount each producer would supply at various prices gave us the figure in column "A" of Table One.

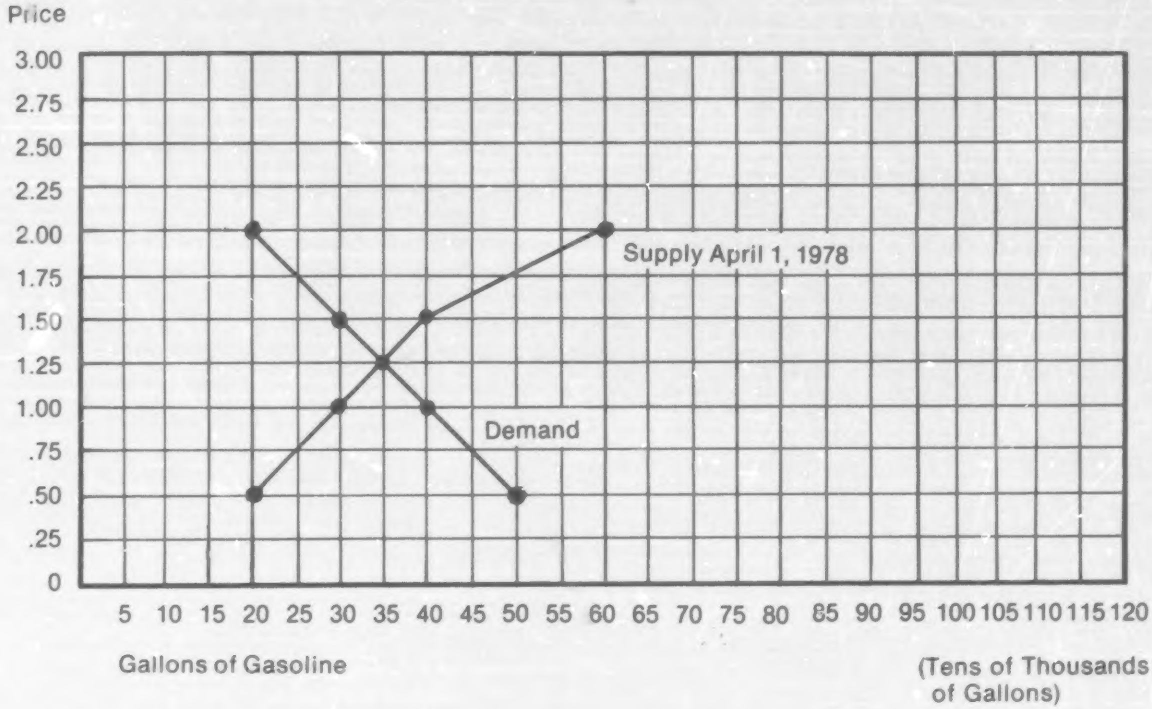
18. What would happen if in March of 1979 one more producer began supplying gasoline in Hoosierland? More gasoline would be offered for sale at each price. The results are shown in Table Three.

TABLE THREE: SUPPLY OF GASOLINE, HOOSIERLAND
May 1, 1979

Amount Supplied (in gallons)	Price (per gallon)
70,000	$2.00
50,000	1.50
45,000	1.25
40,000	1.00
30,000	.50

19. Use the information in Table Three to construct a supply line in Figure C for March 1, 1979.

FIGURE C: SUPPLY OF GASOLINE, HOOSIERLAND, MARCH 1, 1979



20. Notice that the position of the supply line for gasoline shifted to the right (increased) when more producers entered the market.

A shift in the position of the supply line is called a change in supply. It occurs when one or more of the determinants of supply change.

FOREIGN OIL PROBLEMS

21. Some of the gasoline offered for sale in Hoosierland is produced from crude oil found within the country itself. But some of it is produced from crude oil imported from foreign countries.

22. In early 1980, the governments of these oil producing countries had a meeting. They decided to reduce the amount of crude oil shipped to Hoosierland and other oil customers.

23. As a result, Hoosierland gasoline producers were forced to pay much higher prices for the foreign crude oil they used to produce gasoline. This had two effects. Revenues going to the foreign oil producing countries increased sharply. This, of course, was their reason for reducing exports of oil.

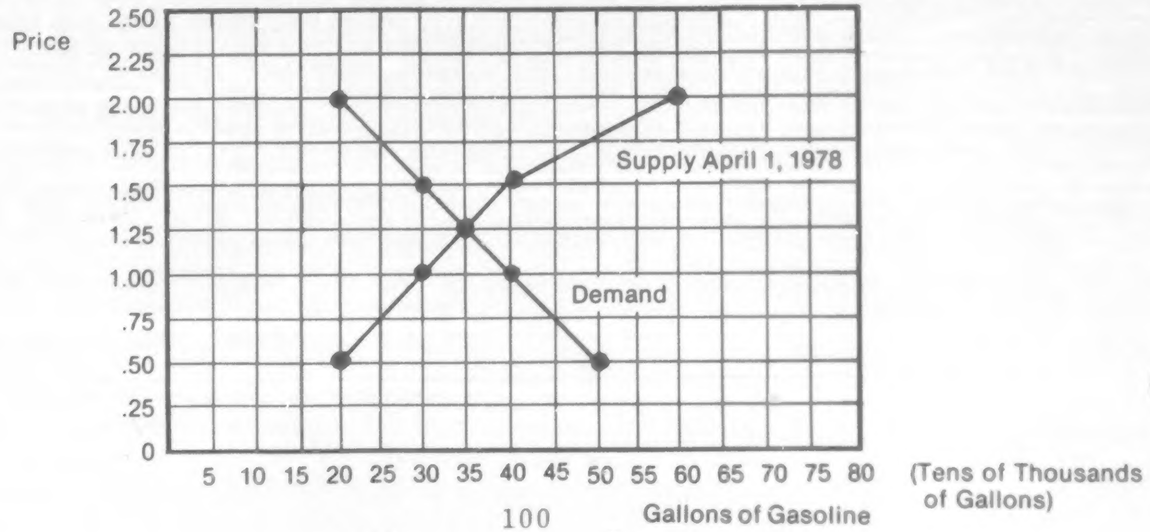
24. The other result was that gasoline producers supplied only half as much gasoline for sale, at any given price, as they had on April 1, 1978. The results are shown in Table Four.

TABLE FOUR: SUPPLY OF GASOLINE, HOOSIERLAND
February 1, 1980

Amount Supplied (in gallons)	Price (per gallon)
30,000	$2.00
20,000	1.50
17,500	1.25
15,000	1.00
10,000	.50

25. Use the information in Table Four to construct a supply line in Figure D below, for February 1, 1980.

FIGURE D: SUPPLY OF GASOLINE, HOOSIERLAND, FEBRUARY 1, 1980



26. Now answer the following questions about Figure D in the space provided. (Assume that the determinants of demand on February 1, 1980 were the same as those that existed on April 1, 1978.)

a) What is the new market clearing price?
b) How was the position of the supply line affected when the price of crude oil increased?
c) How many gallons of gasoline are available for purchase by consumers at this price?
d) How do you think oil companies in Hoosierland would react to the new market clearing price?
e) How do you think consumers would react to the new market clearing price?

LESSON 10: INTERNAL AND EXTERNAL COSTS

CONCEPT: Externalities

RECOMMENDED USE: Middle school (This lesson deals with advanced concepts.)

TIME REQUIRED: 2-3 class periods

MATERIAL REQUIRED: Student materials, included.

ECONOMICS IN THIS LESSON:

Externalities are side-effects that result when the production or consumption of a good or service in the market directly affects the welfare of others, without being reflected through the price mechanism. Externalities occur in both production and consumption, and they can have positive or negative effects. For example, cigarette smoking is increasingly viewed as having detrimental effects on non-smokers in close proximity to smokers. On the other hand, more schooling is regarded as improving the well-being not only of the individuals receiving the schooling but also of others through the creation of a better educated society. Polluting firms along rivers reduce the pleasure derived by people who might swim or fish in the river.

Externalities can be treated in various ways. Positive externalities or external benefits (resulting from education, for example) can be stimulated by subsidizing those activities which produce them. Negative externalities or external costs (resulting from pollution, for example) can be corrected directly by those who produce the externalities, or indirectly by taxing those who produce the externalities, by giving subsidies to help to eliminate the externalities, by compensating those people adversely affected by them, or by direct legal prohibition. If no correction occurs, as often happens, the result is that social welfare is less than it would otherwise be. At the same time, government efforts to correct for externalities are not always successful.

RATIONALE:

The process of producing or supplying energy has always created major costs not borne by the producer of that energy. Such costs are called negative externalities or external costs of production. A typical external cost of production is the damage caused by energy-related pollution.

In recent years, laws have been passed to try to internalize some energy-related external costs, for example by requiring pollution control or increased mine safety. An external cost is internalized when the providers of a good or service pay that cost and pass it on to the consumer.

Not all externalities are negative. Not all externalities are associated with producers. Some result from the actions of consumers. However, in this lesson attention is given only to the external costs associated with production of energy.

If students are to understand the current energy situation, they must be aware of the external costs associated with energy production. They must also learn about efforts to internalize these costs and the effects that the internalization of costs have on the price of energy.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. distinguish between internal and external costs of production;
2. identify the internal and external costs involved in examples of energy production;
3. suggest ways of internalizing some of the external costs involved in energy production.

SUGGESTED TEACHING PROCEDURE:

A. Hand out the student materials and have the students read paragraphs 1-5. These paragraphs introduce the concept of the internal costs of production. Review the characteristics of internal costs of production with students:

   a. Costs of production are paid by producers and are
   b. passed on to the consumer in the price paid for the good or service purchased.
   c. Internal costs of production are paid within the transaction between producer and consumer.
   d. The consumer receives benefits from the producer in return for paying for these costs.

B. Ask students "What are some of the internal costs of the egg farmer's business?" They should answer - buying chicken feed, paying the doctor, buying and maintaining equipment, etc.

C. Have students read paragraphs 6-10. These paragraphs introduce the concept of external costs of production. Review the characteristics of external costs of production with students:

a. External costs of production are paid outside the transaction between producer and consumer, in that
b. the person paying external costs of production receives no benefits from the producer in return for paying them.
c. External costs of production arise when producers ignore certain costs involved in the production process. These costs are inflicted on someone else without compensation.

D. Ask students "What are some of the external costs of the egg farmer's business? Who pays them?" They should answer that the farmer's neighbors pay the external costs of his business.

These costs include dizziness, inconvenience, the cost of medicine, lost property value, and the costs of air-conditioning and sealing their homes.

E. Have students follow the directions in paragraph 11. Answers to the questions related to paragraph "a" are given in the student materials. For the other paragraphs students might respond:

b) i) The value of the fish no longer harvested - recreational value of the fish.
  ii) External. The coal producer did not pay to control the leaking of acid water from the mine. The fishermen must pay the costs that result but receive no benefits for paying those particular costs.

c) i) The cost of drilling for oil - equipment, labor, transportation, etc.
  ii) Internal. It is a cost that was paid by the producer. It will eventually be paid by consumers in the price they pay for gas. But they do get a benefit. Plenty of gasoline is available.

d) i) Poor health is one cost. So is shortened life span and lost work.

ii) External. The producer did not pay to control air pollution. The people in the down wind town must pay the costs that result, but receive no benefits for paying these costs. NOTE: They may receive benefits (heat or light) from the generating station by paying for internal costs of production in the form of utility bills.

F. Have students follow the directions in paragraph 12. They should respond:

WOOD SMOKE

a. They are getting heat. At the same time they have been saving money on energy consumption.

b. One cost is not being able to enjoy the local scenery. If this person has small children there may be medical costs.

c. For the old people who stay, there is the cost of lung problems. For those who leave, there is the cost of giving up a place in which they wanted to live. (Some of these people may themselves be producing the smoke that causes the problem.)

WINDMILL

a. The local people benefit to some extent because they are getting some electricity. But the main benefits will go to people who will obtain electricity in the future at less cost due to improvements in the windmills to be built in the future.

b. The lost beauty of the mountain.
The cost of noise created by the windmill's operation.
The cost of vibration which breaks things.

REACTOR

a. The ones who benefit from the reactor are the people who receive electricity from it. (That might include Jake.)

b. He is losing business. This cost results not from a problem with the local reactor, but because of a problem with the nuclear industry in general. The production of nuclear energy has saddled him with costs for which he is not compensated.

G. Have students think back on the three stories they just finished and on the people who ended up paying external costs of energy production. Then ask "Do you think it's fair that these people had to pay these costs?" Have students explain their responses. Most students will probably say "No, it is not fair. These people are being inflicted with costs without compensation."

H. To end this lesson, review the details of each story. In each case ask "What do you think should be done to solve the problem created by external costs described in this story?" and "How can your suggestions be put into effect?" Accept all reasonable suggestions and implementation strategies.

SUGGESTED EVALUATION STRATEGIES:

1. Have students define internal and external costs of production. Have them give examples of each.

2. Present students with short paragraphs describing costs related to energy production. Have them answer questions similar to those contained in paragraph 11 of the student materials. Here are some possible paragraphs.

   a. Suppose carbon dioxide released by burning fossil fuels causes a warming of the earth. The midwestern corn belt becomes a desert, but vast new areas of Canada and Russia become productive wheatlands.

   b. A worker installing a solar collector falls off the roof and breaks her leg. She is laid up for three weeks. However, her company (by law) carries worker's compensation insurance that pays all her medical bills. The company also has disability insurance that pays her wages while she can't work.

3. Have students examine situations similar to those contained in paragraph 12 of the student materials. Then have them answer questions like those contained in paragraph 16 and step H of Teacher's Guide. Here is one possible story.

COAL TRAIN

Rural City is a small town in a Rocky Mountain state. The railroad track runs through the middle of town, dividing it in half.

Recently, large coal mines have been opened 150 miles north of the town. The railroad carries coal from the mines to electric power plants in other states, and also to seaports for shipment to other countries.

Mike Morley, the town's mayor, summarizes the views of many residents when he says, "This used to be a quiet little town. Well, it's little, but it isn't quiet anymore. Instead of maybe a train a day, now we have a train every hour, and they are noisy."

Mr. Crosby, who owns an ice cream parlor on west Main Street, says: "I know I've lost business because of these trains. People come to town from the farms out east. They want something. Maybe there's a train in town. No way to get through to my store, not while the train's coming through. Likely as not they'll just give up and go home. And an ice cream cone is not like a piece of hardware. A hammer people will buy next trip; they'll never buy an ice cream to replace the one they didn't buy last trip. This whole town can just barely support one store like mine. Half a town can't."

Dr. Brown, one of the town's two M.D.'s, is also worried. "One of these days there's going to be a medical emergency, a fire, something like that, and help won't be able to get through. Then there'll be trouble. The town just has to face up to it. We have to raise money to construct an underpass."

Mothers are especially critical of the trains. Mrs. Ellen Glasgow says, "These trains are a danger to children. The right-of-way isn't fenced, and trains come through town at thirty miles an hour, right through our backyards, really. Children don't know enough to keep out of the way. Two dogs were killed last year. Someday it'll be a child."

The president of the railroad says, "People need this coal, and the railroad is the cheapest way of getting the coal to them. Rural City grew up where it is because of the railroad. It would be easier and cheaper to move the town than to relay the tracks."

SPIN OFF

In recent years, attempts have been made to have energy producers internalize external costs associated with energy production. Invite representatives from local energy utilities to class to discuss how they are controlling air and water pollution associated with their production activities. Ask them to discuss the impact of internalizing these costs on prices that they charge consumers.

An alternative would be to identify government departments charged with monitoring energy producers in terms of their compliance with pollution regulations. Representatives of these agencies could be asked to discuss the extent to which external costs have been diminished as the result of government regulations.

STUDENT MATERIALS: INTERNAL AND EXTERNAL COSTS

1. Imagine that you live in the country. Nearby is a piece of land that is for sale.

2. One day a farmer buys the land. He opens an egg ranch.

3. There are several costs involved in the production of eggs. The farmer buys hens and roosters. He pays the veterinarian to check their health. He must buy and maintain equipment. He also buys a lot of chicken feed.

4. The farmer pays for the chicken feed and these other costs of production. He knows that when he sells eggs, he will have to get his costs back from his customers.

5. The chicken feed and these other costs of production are called internal costs of production. The farmer pays them. He then passes these costs along to the customer in the prices he charges for eggs. So they are costs that are paid within the business transaction between producer and consumer. In this transaction, the consumer pays for the farmer's cost of production, but gets benefits in return; fresh eggs to eat!

6. As it happens, there is one cost of production that the farmer didn't pay. It is obvious to anyone living nearby that the egg ranch smells awful! It smells so bad your head spins, your eyes water.

7. In the course of production this farmer ignores one major cost - waste disposal. As he says, "It's my land so let the chicken droppings fall where they may!"

8. But now you, the egg rancher's neighbor, have some costs. What kind? Well, you pay for medicine to cure the dizziness and watering eyes. You try to sell your house. But you are offered a lot less for it than you would have received before the egg ranch was opened. You end up sealing your windows and buying an air conditioner.

9. Will the farmer pay for your air conditioner? No, he doesn't see your air conditioner as one of his costs of production. Will he pass the cost of your air conditioner along to his customers? Why should he? Will the people who buy eggs from him pay you for the suffering you experienced so that eggs could be produced on the ranch? No way!

10. Your suffering, inconvenience and other costs are called *external costs of production*. They are costs created by the farmer's production activities. They result from his ignoring his waste disposal problem. External costs of production are not paid by the farmer (producer). They are paid by you! They are *outside* the transaction between producer and consumer. You receive no benefits in return for paying these particular costs.

11. Each of the paragraphs below describes a cost related to supplying or producing energy. Answer the questions asked about each paragraph. Use the space provided. An example is done for you.

    a. A coal-burning boiler, used to heat an office building, produces smoke which soils the brick walls of nearby buildings. The owners of these nearby buildings pay to have them steam-cleaned every seven years.

        i) *What is the cost described in this* paragraph? The owners of buildings pay to have them cleaned because they are soiled by smoke.

        ii) *Is this an internal or external cost of energy production? Why?* It is an external cost. The energy producer is not paying to control the smoke produced by burning coal in the office building furnace. The owners of nearby buildings must pay the costs that result, but receive no benefits from the energy producer for paying these costs.

    b. Acid water draining from an old coal mine has killed all the fish in a stream. In that stream, sport fisherman used to catch about 700 pounds of fish a year.

        i) What is the cost described in this paragraph?_____

        ____

        ____

        ii) Is this an internal or external cost of energy production? Why?______________________

        ____

        ____

c. An oil company spends millions of dollars drilling for oil. As a result, gas stations supplied by this company have plenty of gasoline available for customers.

i) What is the cost described in this paragraph?_____

ii) Is this an internal or external cost of energy production? Why?_____

d. In the 1940's, due to air pollution, a small town, downwind from a generating station had a higher rate of respiratory disease than a similar town upwind. As a result, more work-days were lost in the downwind town, and people tended to die younger.

i) What is the cost described in this paragraph?_____

ii) Is this an internal or external cost of energy production? Why?_____

12. Each of the following stories describes a situation in which there is one or more external costs. The situations all involve energy use or supply. (It is important to realize that external costs may occur in a wide variety of situations. They are not associated only with energy related activities). As you read a story, find answers to the questions that appear before it.

WOOD SMOKE

a. What benefits are people getting from wood burning?

b. What costs does wood burning in Mercer put on the young married person who heats his home with an electric heat pump?

____

____

c. What costs do old people who stay in Mercer have as a result of wood burning? What about the old people who move?

____

____

Mercer is a beautiful town in a rural mountain valley. Many people have come here to live just because of its beauty, including many retired people.

Because the prices of other fuels have increased in the last five years, many people in Mercer have started to use wood as their main home heating fuel. However, smoke from the area's many fireplaces and wood stoves has created an air pollution problem. Now a blue haze hangs over the valley all winter long.

At first, people didn't want to admit the haze was caused by burning wood. Now they are asking the city council to pass ordinances limiting the amount of wood a home can burn.

Part of the problem is the scenery. The mountain peaks that ring Mercer can no longer be seen.

Health is involved, too. Infants and old people are especially affected. Doctors have advised older people with lung problems to leave Mercer. Even people who have lived in Mercer all their lives are being forced to sell their homes and leave.

***

WINDMILL

a. Who benefits from the windmill? What benefits do they obtain?

____

____

b. Describe at least three external costs of production that people living near the windmill have as a result of its operation.

____

____

The Department of Energy has erected a large experimental windmill. The windmill generates electricity, which is fed to the homes of local residents, but its main purpose is to test windmill designs. The knowledge that will be obtained by operating this windmill will enable people to build less expensive, more durable wind generators in the future.

But the people who live nearby complain.

"That windmill is the ugliest thing I ever saw," says Bill Hetherow. "It looks like a plane crashed up there. That's not what these mountains are about. If God wanted a windmill up there, he'd 'a put it there."

Other neighbors complain that the windmill is noisy when it is operating.

"Noise isn't the half of it," says Maureen O'Leary. "That machine's cracked two of my best china cups. I can just feel the rumble when it gets going." Engineers testing the machine agree that it does generate subsonic frequencies which might crack glass at a distance.

"That's one of the bugs we're working out," they say.

***

THE REACTOR

a. Who benefits from the reactor?____________________

____

b. What costs is Jake paying?____________________

____

Jake Holburn owns a little resort in an isolated rural section of the state. It includes cabins on a lake with a dock and boats. Jake's place is a clean, pleasant, family-style resort. His regulars have been coming back year after year for almost as long as Jake has been in business. That is, until about two years ago.

Jake's resort is a little more than a mile from a nuclear power plant. In fact, the cooling towers of the plant are plainly visible in a photo on Jake's brochure, rising up behind the hills on the other side of the lake.

Jake says, "My business started falling off right after Three Mile Island. I couldn't figure it out. People were even calling to cancel reservations - families that had been coming for years. So finally I called up some customers I knew really well, and they told me why they weren't coming."

Mrs. Lucinda Counsuelo says, "We've gone to Jake's for about five years and we were very pleased with it. But after hearing on the T.V. about them evacuating children when they had that accident in Pennsylvania and all that stuff, we decided, why take a chance? What if we were at Jake's when something happened? There are plenty of resorts where we can go. Why take the chance?"

Jakes says, "I don't know who's right and who's wrong in this nuclear thing. All I know is, I didn't do anything and I'm going out of business."

LESSON 11: RESPONDING TO CHANGES IN PRICE

CONCEPT: The price mechanism

RECOMMENDED USE: Middle school (This lesson deals with advanced concepts.)

TIME REQUIRED: 1-2 class periods

MATERIAL REQUIRED: Transparencies: "Gasoline Prices"
"Drilling Activity"
"Automobile Gasoline Consumption"
Blackline masters provided.

ECONOMICS IN THIS LESSON:

Price is the principal allocating mechanism of the American economy. Prices act as "signals," flashing information to households, producers, workers, savers, and investors, helping them to decide what are the most rational and profitable decisions to make.

The array of prices confronting individuals and households helps to determine the way they will spend their limited income. The prices of finished goods relative to costs indicate to producers the most profitable items to produce while the prices of productive resources determine other costs of production. Changes in price affect the way consumers spend their money, where workers work, how savings are invested, and what producers produce.

RATIONALE:

There is one aspect of the energy situation in which everyone is interested - price. This lesson examines changes that have taken place in the price of energy. It then considers how people's decisions are affected by these price changes. The lesson is intended to introduce students to the impact of prices on people's decisions.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. obtain information from line graphs;
2. describe some recent trends in energy prices;
3. identify ways in which the decisions of energy producers and consumers are affected by energy price changes.

SUGGESTED TEACHING PROCEDURE:

A. Using the overhead projector, show the graph of gasoline prices. (NOTE: In some classes, it may be necessary to review the idea of line graphs. Several will be used in this lesson. You may want to use the following as part of your classroom review of line graphs.)

Line graphs are useful for seeing the direction (usually upward or downward) that information takes over time. The gasoline prices line graph is about the direction taken by prices between 1965 and 1981.

On a line graph, points are plotted for each piece of information. The distance of each point from the bottom of the graph depends on the particular piece of information it represents.

On the gasoline prices graph, a point is plotted for each year. The distance of the point from the bottom of the graph represents the average price for gasoline in that year.

The numbers along the side of the line graph help the reader determine the exact meaning of the points. In the gasoline price line graph, the numbers along the sides stand for cents per gallon.

The direction taken by the information is found by joining each pair of points with a straight line. The results show the general trend in the information.

B. Ask students "What is this line graph about?" To answer this question, have them inspect the graph title, check the graph sources, and examine the graph notes. They should say something like "This is a line graph about changing gasoline prices in the U.S. The prices are adjusted for inflation. The information is from the U.S. Department of Energy, 1982. It is for the period 1965-1981."

C. Point out to students that because the prices have been adjusted for inflation, they can be accurately compared. Also point out that the prices on the graph are not the prices that appeared on the pump at gasoline stations.

D. Have students describe how the price of gasoline changed between 1965 and 1980. Ask them:

i) How did prices adjusted for inflation change between 1965 and 1973? (Student response - Prices fell slowly.)
ii) How did prices adjusted for inflation change between 1973 and 1974? (Sharp increase)
iii) How did prices adjusted for inflation change between 1974 and 1978? (Slow decrease)
iv) How did prices adjusted for inflation change after 1978? (Very sharp increase)

NOTE: Record these answers on the chalkboard for later reference.

E. Tell students that changes in energy prices affect decisions made by producers and consumers of energy. Have them speculate about how price changes seen in the gasoline graph would affect producers and consumers.

Ask "How do you think energy producers (oil companies) would repond to changes in gasoline prices? If the price of gasoline went up, would they increase or decrease the pace at which they drill for new oil to make into gasoline? If the price of gasoline goes down, would producers do more or less drilling?" Use a table like the one that follows to record student answers.

	Drilling Activity	
Price of gasoline	More	Less
Up		
Down		

Ask "How do you think energy consumers would respond to changes in gasoline prices? If the price went up, would people use more or less gas? What would they do if the price fell?" Use a table like the one that follows to record student answers.

	Consumption of Gasoline	
Price of gasoline	More	Less
Up		
Down		

Record student answers on the chalkboard. This recording should not be done for evaluation purposes but simply to motivate students to examine the evidence which follows.

F. Project the transparency "Drilling Activity". Ask students to describe changes in the number of new wells drilled per year since 1965 for the four time periods used in Step D, above. Record answers on the chalkboard so that they can be compared to those developed in Step D. Students should respond:

i) 1965-1973: drilling activity slowed down (except for 1966 and 1969);
ii) 1973-1974: a jump in drilling activity;
iii) 1974-1978: an increase;
iv) 1978- sharp increase.

G. Have students spend a few minutes comparing these results to their predictions. Who was right? (With the exception of the 1974-1978 period, activity increased as prices went up, and slowed as prices fell.)

H. Ask students "Why do you think oil companies would increase their exploration activities (drilling new wells) when gasoline prices increased during the late 1970's and early 1980's?" A variety of answers are possible.

I. Show the transparency "Automobile Gasoline Consumption." Ask students to describe changes in the number of gallons consumed per vehicle since 1965 for the four time periods used in Step D, above. Record answers on the chalkboard so that they can be compared to those developed in Step D. Students should respond:

i) 1965-1973: consumption went up
ii) 1973-1974: sharp decrease
iii) 1974-1978: sharp increase
iv) 1978-1981: sharp decrease

J. Have students spend a few minutes comparing the results to their predictions. Who was right? (There is a clear relation between price and consumption. When price fell, consumption increased. When price went up, less was consumed.)

K. Ask students "Why do you think energy consumers would purchase less gas when the price went up in the late 1970's and early 1980's?" A variety of answers is possible.

L. To conclude this activity, have students suggest other ways in which producers and consumers can respond to an increase in the price of a product like gasoline. They might suggest:

Consumers could find substitutes for gasoline, like walking, riding bus.
Producers could increase their productivity, making better use of existing energy sources.
Consumers could try to do without energy.

SUGGESTED EVALUATION STRATEGY:

1. Provide students with line graphs of energy product prices like electricity. Ask them to describe what the graphs are about. Have them answer questions about the information portrayed in the graph, similar to those posed in this lesson.

2. Ask students to describe in writing or in graphic form trends in prices of gasoline through 1981.

3. Create a list of short statements describing decisions made by energy producers and consumers. Have students identify those statements reflecting decisions most likely to follow from energy price increases. Here are some examples of decision statements.

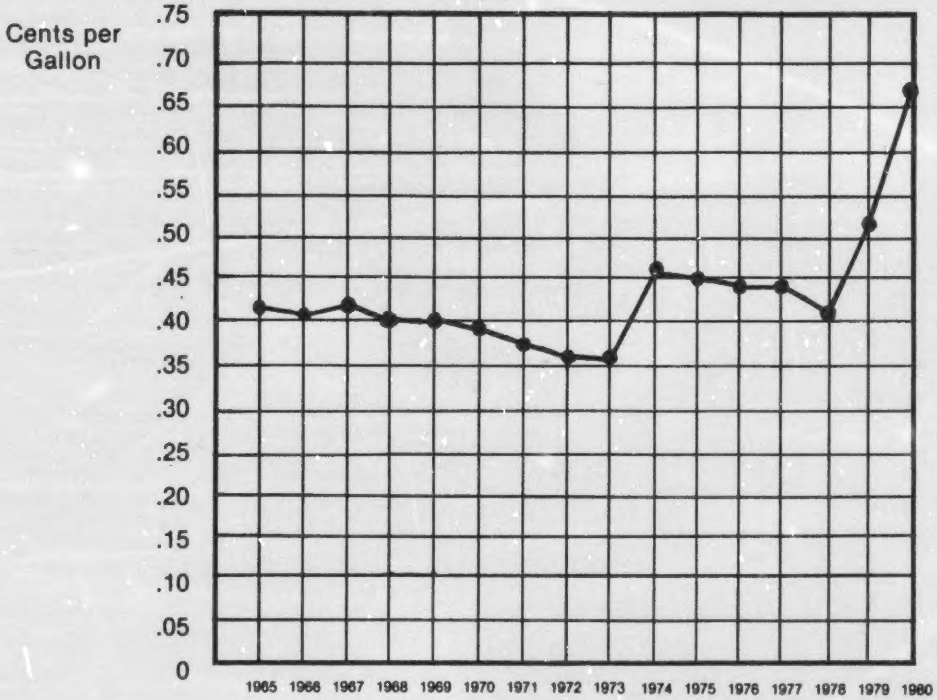
   i) Consumers use less natural gas to heat their homes than previously (associated with an energy price increase).
   ii) Producers develop new technique for extracting oil from existing wells (associated with an energy price increase).
   iii) Consumers start buying large "gas-guzzler" cars again (not associated with an energy price increase.)

SPIN OFF

In 1983, the price of certain forms of energy has been decreasing. Have students collect articles from news magazines that describe this trend. Have students use the contents of these articles to identify the ways in which the decisions of energy producers and consumers have been affected by this downward trend in prices.

TRANSPARENCY I

GASOLINE PRICES*
U.S. 1965-1980

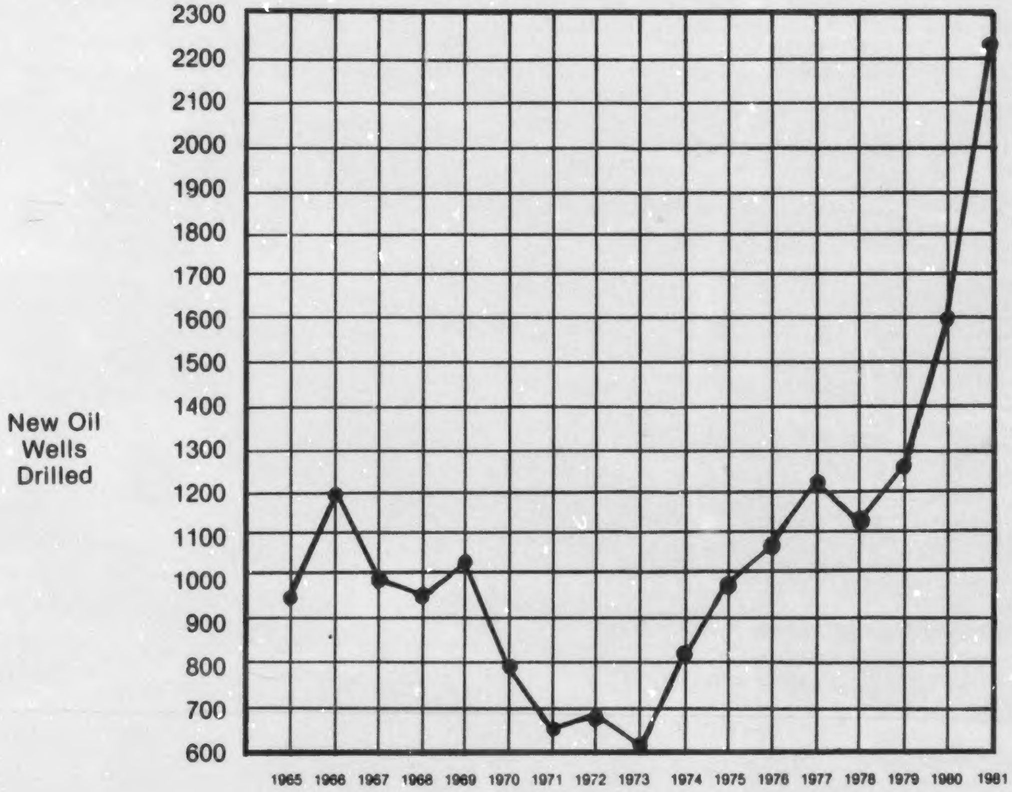


*NOTE: Prices have been adjusted for inflation

Source: U.S. Department of Energy, 1982

TRANSPARENCY II

DRILLING ACTIVITY*
U.S. 1965-1981

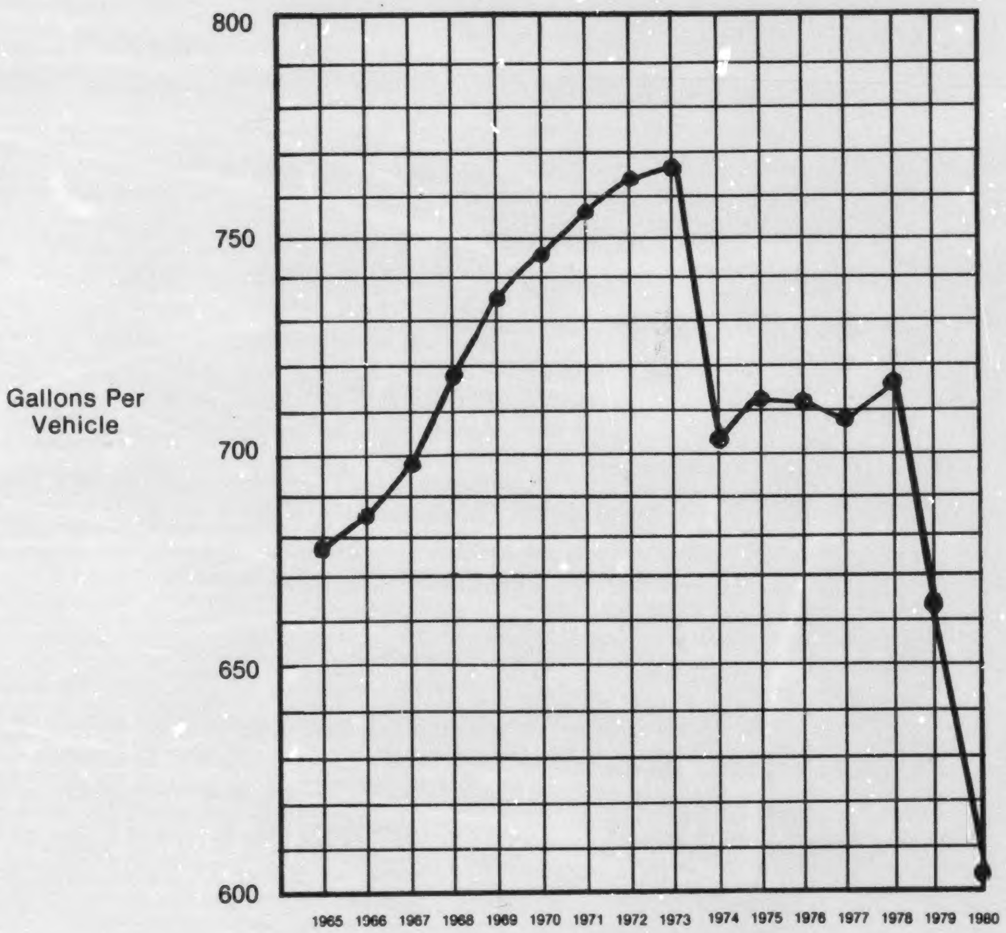


*NOTE: New Oil Wells Drilled

Source: U.S. Department of Energy, 1982

TRANSPARENCY III

AUTOMOBILE GASOLINE CONSUMPTION
U.S. 1965-1980



Source: U.S. Department of Energy, 1982

LESSON 12: PRICE CEILING

CONCEPT: Price ceilings

RECOMMENDED USE: Middle school (This lesson deals with advanced concepts.)

TIME REQUIRED: 1-2 class periods

MATERIAL REQUIRED: Student materials provided

ECONOMICS IN THIS LESSON:

In the American economy the questions of what to produce, how to produce it, and how to share it are not left exclusively to free market forces. In our mixed economy, government plays a key role. Control over the production of some goods and services (such as national defense, highways and justice) has been removed from the private sector and placed in the public sector where government makes the important decisions. Government also intervenes in many markets with regulations and controls with the intent to improve upon the results produced by the free play of market forces. Examples are public utility regulation, tariffs, minimum wage laws, antipollution and safety requirements, price ceilings and floors. Finally, through its taxing and spending activities, government shifts control over resources from private hands to the public, and it also redistributes income among individuals through transfer payments. These activities influence what and how much will be produced, how it will be produced, and how it will be shared or used.

RATIONALE:

Price rations goods and services. Goods and services will go to those consumers who can and want to pay the market clearing price.

Sometimes a society decides that price rationing is not the best way to allocate goods and services. Price ceilings are sometimes used to make sure that prices of some items such as food or gasoline do not go too high.

Price controls have side effects. It is important for students to understand why price ceilings are sometimes imposed, what the consequences (costs) are, and if the benefits are worth the costs.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson. learners will be able to:

1. define "price ceiling";
2. identify situations in which a price ceiling is likely to be imposed;
3. identify who benefits and who incurs costs when a price ceiling is imposed.

SUGGESTED TEACHING PROCEDURE:

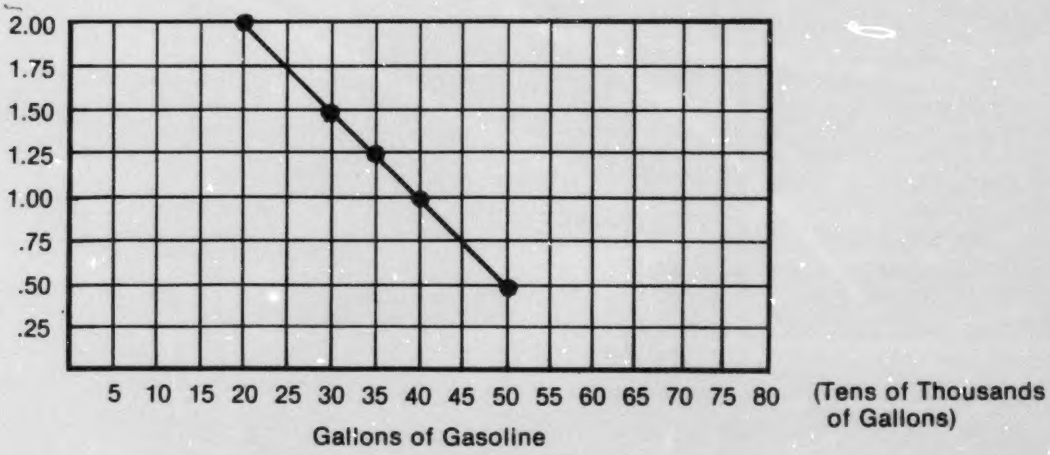
NOTE: If you have covered the lesson "Supply, Demand and Prices in the Energy Market," with your students, you can have them move quickly through paragraphs 1-10 of the student materials.

A. Have students read through paragraphs 1 and 2.

NOTE: The phrase "other things being equal" is explained in the lesson "Supply, Demand and Prices in the Energy Market." It can be ignored for the purposes of this lesson.

Have students follow the directions in paragraph 3. Their line graphs should look like this:

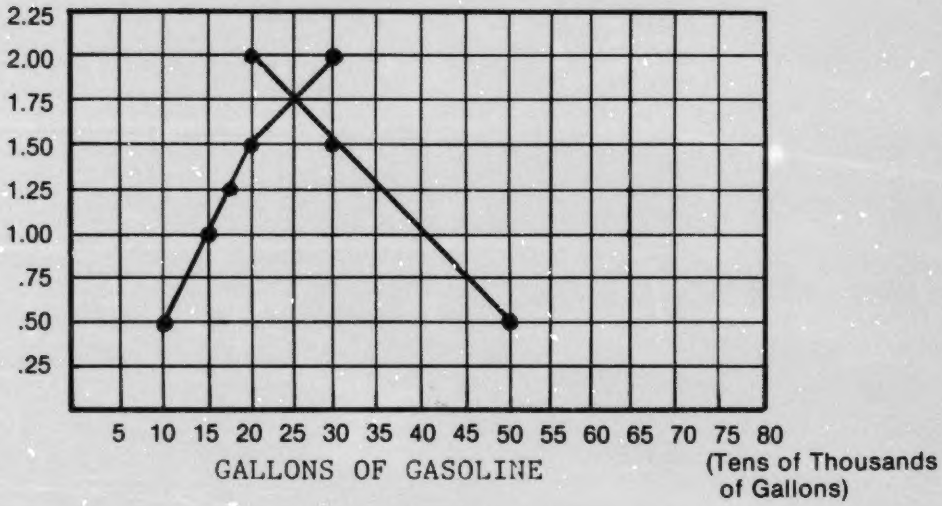
Figure A- DEMAND FOR GASOLINE, HOOSIERLAND
Oct. 1,1980



B. In response to the question asked in Paragraph 4 they should say "C".

C. Have students read paragraph 5 and follow the directions in paragraph 6. Their line graphs should look like the one below.

FIGURE A- DEMAND FOR GASOLINE, HOOSIERLAND
OCT. 1, 1980



D. In response to the question in paragraph 7, they should say "A".

E. Have students read paragraphs 8-10 and review the meaning of market clearing price as a class (the price at which producers are willing and able to offer for sale the same amount of gasoline as consumers are willing and able to purchase.)

F. Paragraph 11 points out that price along with other things affects decisions made by consumers and producers.

G. The idea presented in paragraph 12 actually introduces the main theme of this lesson. Have students read this paragraph carefully. Be sure they understand that price can play a rationing role.

H. Have students read paragraphs 13 and 14. Review the main points of these paragraphs as a class.

   i) Price ceiling- a government price control that sets an upper limit on the price that can be charged for a particular good or service.

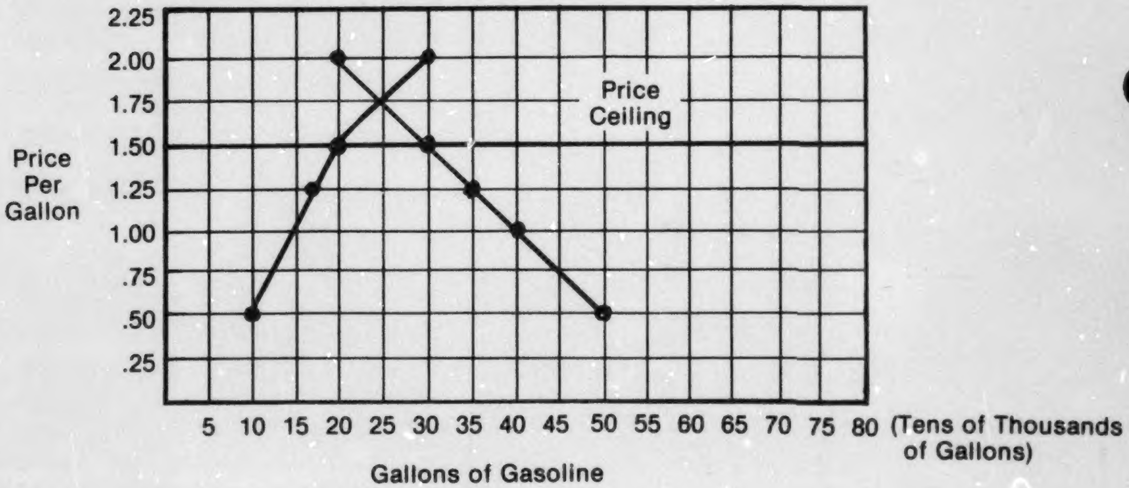
ii) Price ceiling- usually used when it is feared that the price of a vital basic good will be too high for people, especially poor people, to afford.

I. Paragraphs 15-16 "set the scene" for the establishment of a price ceiling in Hoosierland. This may be a good time to tell students that while Hoosierland is a fictional place, the workings of the market and the impact of the price ceiling are realistic.

J. Have students read paragraphs 17 and 18. Ask "Why did the government of Hoosierland decide to impose a price ceiling on gasoline?" They should respond, "The government feared that the burden of the new market clearing price was too great for people, especially the poor."

K. Have students follow the directions in paragraph 19. Their "price ceiling lines" should look like this:

FIGURE A: DEMAND FOR GASOLINE, HOOSIERLAND
October 1, 1980



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L. They should respond to the questions in paragraph 20 as follows:
   a) 30,000 gallons;
   b) 20,000 gallons;
   c) The price ceiling was set below the market clearing price. So, more gallons of gasoline were demanded than were supplied. This resulted in a gasoline shortage. When a shortage occurs, people spend more time searching for gasoline and waiting in line to purchase it.
   d) Answers may vary. Accept all reasonable suggestions such as:

COSTS

- The poor themselves - Time and money are wasted looking and waiting for gas.
- Everyone else who must deal with the shortage by searching and waiting
- People who work for oil companies. Companies have no incentive to produce more gasoline so they don't hire workers.
- Gasoline stations - must deal with unhappy customers.

BENEFITS

- Those who manage to get some of the gasoline at less than the market price with minimum or no search costs.
- Those with few other ways to spend their time.

SUGGESTED EVALUATION STRATEGY

1. Ask students to define price ceiling.

2. Provide students with short statements describing situations in which prices change rapidly. Have them identify which of these are situations in which price ceilings are likely to be imposed. Some sample statements:

   a. Because of the popularity of jellybeans in Washington, D.C., the price of a pound increases from $.75 a pound to $1.35. (No price ceiling likely, not a vital commodity)

   b. Because of a series of outbreaks of disease four years ago, fewer cattle are being delivered to market. The price of ground beef increases from $.89 a pound to $2.15 a pound. (Yes, a ceiling is possible here.)

3. Have students identify who would benefit and who would incur costs if a price ceiling was imposed in the situation described in 2 b. above.

SPIN OFF

The role that government should play in controlling energy prices is an issue often debated by labor leaders, consumer group members and energy industry executives. Invite representatives of these groups in to present their particular points of view.

Encourage students to prepare questions to ask guest speakers, using material in the lesson as a guide. For example:

- Is there a situation in which price ceilings should be imposed?
- What are some consequences?
- Who is aided, who is hurt by price ceilings?

Students should also "role play" interviewers and interviewees before the guest comes to class. Students could use material gathered from guest interviews as the basis for a debate on the pro's and con's of price controls.

STUDENT MATERIALS - PRICE CEILINGS

BACKGROUND

1. Below is a table showing information about gasoline supply and demand for the fictional country of Hoosierland about 3 years ago.

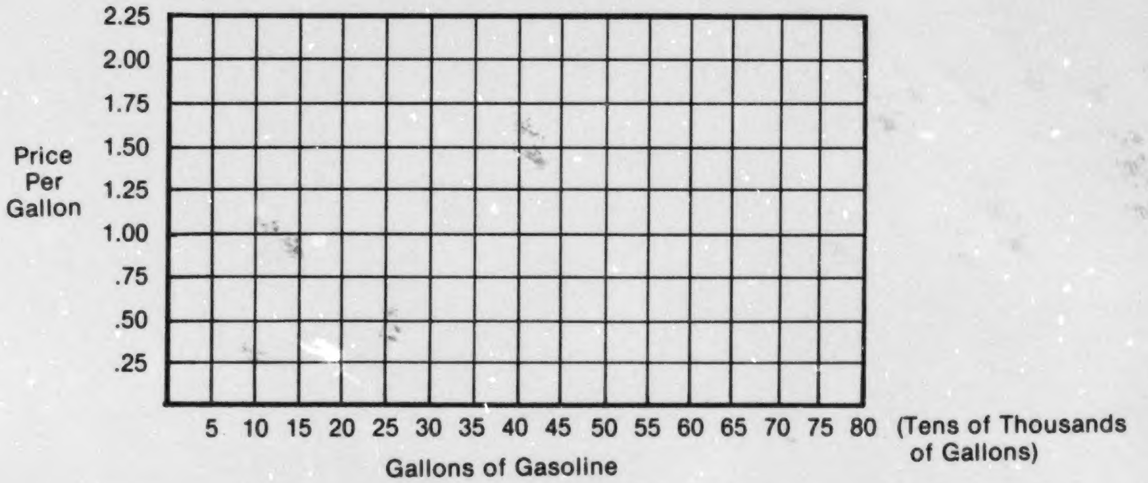
TABLE ONE: DEMAND FOR GASOLINE, HOOSIERLAND
October 1, 1980

Amount Supplied (in gallons)	Price (per gallon)	Amount Demanded (in gallons)
30,000	$2.00	20,000
20,000	1.50	30,000
17,500	1.25	35,000
15,000	1.00	40,000
10,000	.50	50,000

2. The right hand column of Table One shows demand for gasoline in Hoosierland on October 1, 1980. Demand refers to the amount of a product, in this case gasoline, that people are willing and able to purchase at various prices, other things being equal. The table says that if gasoline was offered for sale at $2.00 a gallon, the quantity demanded would be 20,000 gallons. If the price was a $1.00, the amount would be 40,000 gallons.

3. Use the information in the "price" and "amount demanded" columns of Table One to construct a line graph in Figure A which follows. Notice that in Figure A gallons of gasoline are shown along the horizontal axis. Price is shown along the vertical axis.

FIGURE A: DEMAND FOR GASOLINE, HOOSIERLAND
October 1, 1980



4. Which one of the following conclusions can be drawn from the demand line graph that you constructed?

   a) The amount of gasoline demanded does not seem to be affected by prices.
   b) As price increases, the quantity of gasoline demanded also increases.
   c) The amount of gasoline demanded decreases as the price increases.

5. The left hand column of Table One shows the supply of gasoline in Hoosierland on October 1, 1980. Supply refers to the amount of a product, in this case gasoline, that producers are willing and able to offer for sale at various prices, other things being equal. The table says that if gasoline could be offered for sale at $2.00 a gallon, the amount supplied would be 30,000 gallons. If the price was $1.00 the quantity supplied would be 15,000 gallons.

6. Use the information in the "price" and "amount demanded" columns of Table One to construct a supply line graph on Figure A.

7. Which one of the following conclusions can be drawn from the supply line graph you constructed?

   a) As price increases, the amount of gasoline supplied also increases.
   b) The quantity of gasoline supplied does not seem to be affected by price.
   c) The amount of gasoline supplied decreases as the price increases.

8. You will notice that there is one point in Figure A at which the demand line and the supply line intersect. It is at the $1.75 a gallon price level.

9. If the price of gasoline is $1.75 a gallon - 25,000 gallons will be demanded and supplied. At that price producers are willing and able to offer for sale the same amount of gasoline as consumers are willing and able to purchase.

10. One dollar and seventy-five cents ($1.75) is called the market clearing price in this situation. All gasoline offered for sale would be purchased at that price.

11. Price and other things (e.g., the price of crude oil) determine how much producers are willing and able to offer for sale. Prices and other things (e.g., income) also determine how much consumers are willing and able to purchase. At the market clearing price, the amounts are the same.

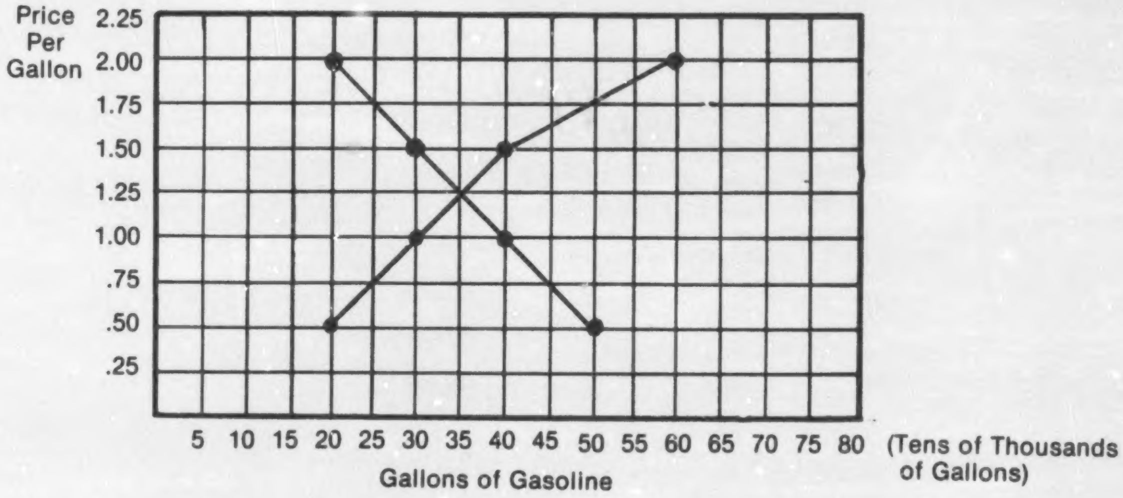
12. Price also determines who will purchase the product. If gasoline, for example, is sold at $1.75 a gallon in Hoosierland, 25,000 gallons will be purchased. But it will be purchased only by those consumers who are willing and able to spend $1.75 for a gallon of gas.

13. Sometimes governments decide that the price charged for a product is too high. This usually happens in the case of basic goods and services like food, fuel, housing, and medical care. The fear is that poor people will not be able to purchase enough of these goods and services to satisfy their needs, if prices are high.

14. In a situation like this, the government may control prices by establishing a price ceiling. A price ceiling sets an upper limit on how much can be charged for a particular good or service. It is enacted by a government.

15. Imagine that Figure B portrays the supply and demand situation for gasoline in Hoosierland in early September, 1980. Notice that the market clearing price was $1.25 a gallon.

FIGURE B: DEMAND FOR GASOLINE, HOOSIERLAND
September 10, 1980



16. Then, in September 1980, Hoosierland gasoline producers decided, because of the higher price of crude oil, to cut back on the amount of gasoline they were willing and able to supply at each price level. The result was the situation shown in Figure A, with a market clearing price of $1.75.

17. The government of Hoosierland decided that $1.75 a gallon was too high a price for people to pay for gasoline. They felt that someone consuming 20 gallons of gasoline a week would end up paying $10.00 extra a week for gasoline. This, the government felt, was too much of a burden for people, especially poor people, to bear.

18. The government enacted a law requiring gasoline stations to charge no more than $1.50 a gallon. A price ceiling was thus established at $1.50.

19. Draw a straight line, parallel to the horizontal axis, all the way across Figure A, at the $1.50 a gallon level.

20. With the price ceiling line in place, answer the following questions:

    a) How much gasoline would consumers be willing and able to purchase at $1.50 a gallon?
    b) How much gasoline would producers be willing and able to offer for sale at $1.50 a gallon?
    c) When the price ceiling of $1.50 a gallon for gasoline was established in Hoosierland, consumers spent more time searching for service stations that had gasoline to sell. They also spent more time waiting in line to buy gasoline. Why do you think this was true?
    d) Price ceilings are usually established to help poor people. Who benefits and who incurs costs when a price ceiling for gasoline is established?

FREE AND INEXPENSIVE RESOURCES ON
ENERGY AND ECONOMICS

A NOTE TO TEACHERS

The Indiana Energy Information Center (IEIC) operates an energy information service which is available to all Indiana residents. The IEIC maintains, for dissemination, a wide variety of energy information and materials covering all topics on the following resource list. Single copies of these materials are free. For an IEIC publications list call the:

ENERGY HOTLINE
1 - 800 - 382-4631

or write the:

Indiana Energy Information Center
Division of Energy Policy
Indiana Department of Commerce
1 N. Capital, Suite 700
Indianapolis, IN 46204

The IEIC Staff is "on-call" (via the ENERGY HOTLINE) to help Indiana residents with many kinds of energy questions. Speakers and other energy related services are also available through IEIC.

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COAL

*Edison Electric Institute
Educational Services
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Washington, D.C. 20036

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*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180 - Room 4187
Houston, TX 77001

Coal Pocket Data. Tables, charts, and maps of Exxon's coal operations, plus statistics on U.S. and world coal production. 399 pp. Free.

*National Coal Association
1130 - 17th Street, N.W.
Washington, D.C. 20036

Coal: a 24-page, illustrated reprint of The World Book encyclopedia article on coal. Grades 7-12. Single copies free.

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1925 K Street, N.W.
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*Association of Home Appliance
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Chicago, IL 60606

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*Channing L. Bete, Co. Inc.
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South Deerfield, MA 01373

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*Consumer Information Center
Public Documents Distribution Center
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*Edison Electric Institute
Educational Services
1111 - 19th Street
Washington, D.C. 20036

How to Save Energy With Better Use Habits: 1980, 18 pages. Conservation and energy management. Sample copy free.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180-Room 4187
Houston, TX 77001

Drive Like There's No Tomorrow: A booklet discussing the benefits of driving at 55 mph. Free.

Mickey Mouse and Goofy Explore Conservation: Comic book that can be used as an energy conservation teaching aid. Free.

*Sierra Club
Information Services
530 Bush Street
San Francisco, CA 94108

Energy Conservation: An Immediate and Reliable Alternative: 8 pages. Includes reading and reference lists. 25 cents.

*Tenneco Inc.
Public Affairs Department
P.O. Box 2511
Houston, TX 77001

The Fourth R: Resourcefulness in School Energy Conservation: A booklet used as a companion to Tenneco's film, "The Fourth R." Describes school energy problems and illustrates typical solutions. Free.

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Video Duplication Service
Room 229, State House
Indianapolis, IN 46204

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Public Affairs
16 B4 Phillips Building
Bartlesville, OK 74004

American Enterprise: A series of five 28-minute films documenting our country's economic history. Teaching Guide. "Teaching Notes" newsletter. Permission available to educational institutions to duplicate at no charge on videotape. Films or videocassette available free on loan from two sources. Karol Media, 625 From Road, Paramus, NJ 07652, toll free phone (800)526-4773; and Modern Talking Picture Service, 5000 Park Street North, St. Petersburg, FL 33709, phone (813)541-6661.

*Standard Oil Company (Indiana)
Public and Government Affairs
Mail Code 3705, P.O. Box 5910-A
Chicago, IL 60680

The Kingdom of Mocha: Animated 16mm color film introduces economic concepts about the free market system in relation to the energy needs of society. Free on loan. Modern Talking Picture Service, 5000 Park Street, North, St. Petersburg, FL 33709.

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*Edison Electric Institute
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Washington, D.C. 22036

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*Alliance to Save Energy
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*American Gas Association
1515 Wilson Boulevard
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Special Report on Energy. A 115-page special edition of National Geographic magazine devoted entirely to energy. Includes 12-page atlas of America's energy resources, history of energy crisis, proposed solutions. Copyright 1981. 1-9 copies, $1.45 each/10-99 copies, $1.15 each/ 100 or more copies $1.00 each.

*Sierra Club
Information Services
530 Bush Street
San Francisco, CA 94108

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Energy and the Sierra Club: A summary of Sierra Club energy policy. 15 pages. 40 cents.

*Sohio Film Library
2515 Franklin Road
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*American Petroleum Institute
Publications and Distribution Section
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*Atomic Industrial Forum, Inc.
Publications Office
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Audio-Visuals on Energy: A listing of films on general energy topics, nuclear energy, and supplemental energy sources. Up to three copies free.

*Center for Renewable Resources
Publication Department
641 South Pickett Street
Alexandria, VA 22304

Solar Energy Education Bibliography for Elementary, Secondary and College Students: This interdisciplinary bibliography covers selected solar activities, reading lessons, and background materials on sun, wind, water and biomass. February, 1980. 75 pages. $3.95 plus 15 percent postage/handling.

*Chevron U.S.A. Inc.
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*Education Commission of the States
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*National Association of Elementary
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Schools Find Answers to the Energy Crunch: From Principal, Vol. 60, No. 4, March, 1981 - pages 23-5, by Roger Wall. $5.00.

*National Council for the Social Studies
3615 Wisconsin Avenue, N.W.
Washington, DC 20016

Teaching About the Energy Crisis: A special section of Social Education, edited by Judith Gillespie, April, 1980. $1.50.

Guidelines for Energy Education: Social Education, November/December, 1981. $5.00.

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Electric Energy Education Aids: Flier documents all materials available on electric energy. Free.

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*Sierra Club
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Information Services Literature List: Listing of Sierra Club publications available. Revised semi-annually.

*Standard Oil Company (Indiana)
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Mail Code 3705, P.O. Box 5910-A
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Amoco Teaching Aids: A 5-page folder listing teaching aids available to help students understand basic economic concepts and energy-related needs, resources, and problems.

*The Standard Oil Company (Ohio)
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*U.S. Department of Energy
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P.O. Box 62
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ENVIRONMENT

*American Petroleum Institute
Publications and Distribution Section
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Washington, DC 20037

A Shore For All Purposes: #877-68070. This illustrated booklet is a summary of the Coastal Zone Management (CZM) Act of 1972, including the subsequent amendments of 1974 and 1976. The booklet focuses on the purpose of CZM and the reasons for its adoption as law. Free.

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Education Services
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Washington, DC 20036

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*Mobil Oil Corporation
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150 East 42nd Street
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Research Summary Editor
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*American Gas Association
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Science Principles and Gas Appliances With Experiments: #N00500. Elbert C. Weaver, 1970. A 32-page booklet on science principles used in six gas appliances: range, home heater, water heater, clothes dryer, incinerator, air conditioner, with twelve classroom experiments. Materials for overhead projection and sample report sheet included. Grades 7-9. $1.60.

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Nuclear Power in American Thought: Decisionmakers Bookshelf series. 1980, 92 pages. #01-070831. Book examines social, political, philosophical and psychological aspects of nuclear power in America. $2.50.

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Nuclear Wastes: Reprint from July/August 1979 issue of Sierra. 6 pages. 25 cents.

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The Search for Offshore Oil and Gas: #862-60682. This booklet examines one of the sources for increased U.S. energy - the crude oil and natural gas resources underlying our coastal waters. Free.

*Channing L. Bete Co., Inc.
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South Deerfield, MA 01373

ABC's of Oil: Booklet explains how oil is located, drilled, refined and transported. Single review copy free. Quantity pricing information available on request.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180 - Room 4187
Houston, TX 77001

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P.O. Box 2463
Houston, TX 77001

The Story of Petroleum: A primer on the history and key functions of the oil industry - exploration and production, transportation, refining and marketing, and the manufacture and marketing of petro-chemicals. Free.

*Standard Oil Company (Indiana)
Public and Government Affairs
Mail Code 3705, P.O. Box 5910-A
Chicago, IL 60680

Catalysts and Crude: A 22-page booklet about petroleum refining. Free.

Oil In Depth: A 30-page booklet about petroleum exploration and production. Free.

*Sohio Film Library
2515 Franklin Blvd.
Cleveland, OH 44113

Pipeline Alaska: 16 mm, 28-minute color film. Tells the story of the trans-Alaska pipeline. Free on loan.

*Union Oil Company of California
Corporate Communications, Dept. A
Box 7600
Los Angeles, CA 90051

The Story of Oil: An illustrated wall poster featuring cartoon characters telling the story of oil from its formation to its many uses. Free (limit three copies).

*U.S. Environmental Protection Agency
Publications Office
401 M Street, S.W.
Washington, DC 20460

Unleaded Gas...The Way to Go: Pamphlet that answers the most commonly asked questions about unleaded gasoline. Free.

RENEWABLE ENERGY SOURCES

*Center for Renewable Resources
Publications Department
641 South Pickett Street
Alexandria, VA 22304

Solar Energy Education Packet for Elementary and Secondary Students: This packet of reading lessons contains plans for solar activities and background materials about all forms of renewable energy. Over 25 student projects. September, 1979. 64 pages. $4.25 plus 15 percent postage/handling.

*CAREIRS: Conservation & Renewable
Energy Inquiry & Referral Service
P.O. Box 8900
Silver Spring, MD 20907

Solar Bibliography: Bibliography of elementary through high school energy education materials. Free.

Note: CAREIRS also distributes literature and answers questions on the following topics: energy conservation, solar, wind, wood, bioconversion, alcohol, fuels, photovoltaics, solar thermal and small-scale hydropower.

*Consumer Information Center
Public Documents Distribution Center
Pueblo, CO 81009

Heating With Wood: Types of fireplaces, stoves and furnaces. Buying and burning wood efficiently and safely. $2.00.

Homeowner's Solar Sizing Workbook: How to select the most efficient solar heating system for your home. $4.00.

Wind Energy Information Directory: Lists of government offices, manufacturers/distributors, colleges and universities, computer programs, organizations, audio-visuals, books and periodicals. $2.75.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180 - Room 4187
Houston, TX 77001

Mickey Mouse and Goofy Explore Energy: Comic book characters lead a search through the ages for new sources of energy and better ways to use it. Free.

*Union Oil Company of California
Corporate Communications, Dept. A
P.O. Box 7600
Los Angeles, CA 90051

Geothermal Energy: A 12-page illustrated booklet explaining the harnessing of the natural heat of the earth. Available in classroom quantities to teachers. Free.

The Story of Geothermal Energy: An illustrated foldout poster showing how the earth's heat is being used to provide electrical energy. Limit three copies. Free.

SYNTHETIC FUELS

*American Petroleum Institute
Publications and Distribution Section
2101 L Street, N.W.
Washington, DC 20037

Supplementary Energy Sources: #877-69500. A booklet discussing the need to develop alternate fuels that could help America to meet its growing demand for energy in the future. Includes sections on coal, liquid fuel and coal, gas from coal, oil shale, tar sands, geothermal, nuclear, solar, biomass, wind, tide and ocean. Single copies free; additional copies 25¢ each.

*Channing L. Bete Co., Inc.
200 State Road
South Deerfield, MA 01373

Energy Sources Booklets: "About Coal," "Coal Gasification," and "Oil Shale." Single review copies free. Quantity pricing information available on request.

*Edison Electric Institute
Education Services
1111 - 19th Street, N.W.
Washington, DC 20036

Alternative Energy Sources - Answers to Your Questions: 1981. 52 pages. Sample copy free.

GLOSSARY

IMPORTANT ENERGY AND ECONOMICS WORDS

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ATOM - The basic building block of all matter, an atom is the smallest particle of a chemical element (such as iron, hydrogen, gold or uranium) that still has the properties of that element.

BARREL - Although seldom put in actual "barrels", crude oil is measured in a unit called the barrel, equal to 42 U.S. gallons. One barrel of crude oil has the same energy as 350 pounds of coal.

BASIC ECONOMIC QUESTIONS - Every economic system must answer these questions: What shall be produced? How shall it be produced? How much shall be produced? For whom shall it be produced?

BREEDER REACTOR - A nuclear reactor that makes more nuclear fuel than it uses, by changing certain atoms that will not split into atoms that will split.

BRITISH THERMAL UNIT (BTU) - The amount of heat necessary to raise the temperature of one pound of water 1° F.

CAPITAL RESOURCES - Goods such as tools, machines, or factories that are used to produce other goods and services.

CARTEL - An agreement among firms not to engage in price competition. Production quotas may also be set and penalties for violations agreed upon. Cartels are not legal in the United States.

COAL - A solid fuel, mostly carbon, formed from the fossils of plants living hundreds of millions of years ago.

COAL GASIFICATION - A chemical process to change coal into fuel similar to natural gas; the biggest advantage is that sulfur and other pollutants in coal can be removed before it is burned.

COAL LIQUEFICATION (COAL HYDROGENATION) - A chemical process to change coal into liquid fuels similar to gasoline and kerosene; compare with coal gasification.

CONSTANT PRICE - Current price adjusted for inflation.

CONSUMER - A user of goods and services to satisfy wants.

CONSUMPTION - Using goods and services to satisfy wants.

COOLANT - Anything pumped through a nuclear reactor to cool it or absorb the heat it produces. Common coolants are water, air, helium, and liquid sodium metal.

CRITICAL MASS - The smallest amount of nuclear fuel, like uranium, that will sustain a nuclear chain reaction of splitting atoms.

CRUDE OIL - Liquid fuel formed from the fossils of animals and plants at the bottom of ancient seas; petroleum as it comes from the ground.

CURRENT PRICE - The price that exists at a particular time, e.g., pump price for gasoline.

DEEP MINING - Mining that must be performed by digging underground shafts and tunnels.

DEMAND - The amounts of a good or service that buyers will be willing and able to purchase at each possible price at a given time.

DEMAND CURVE - The demand for a good or service shown graphically with price on the vertical axis and quantity demanded on the horizontal axis.

DEMAND SCHEDULE - A table showing the number of units of a good or service that would be demanded at various prices.

DIRECT ENERGY CONVERSION - The process of changing any other form of energy into electricity without machinery that has moving parts. For example, a battery changes chemical energy into electricity by direct energy conversion.

DIVISION OF LABOR - Breaking down work into different operations.

ECONOMICS - The study of the way scarce resources are allocated in order to satisfy wants. Economics looks at the way goods and services are produced, distributed and consumed.

EFFICIENCY - A measure of how effective an economy is in using resources to meet consumer demands for goods and services.

EFFICIENCY, THERMAL - A measurement of how efficiently any device changes heat into another energy form. For example, a modern coal-burning electric plant has about 38 percent thermal efficiency because just under 4/10 of the heat from burning the coal is actually changed into electricity.

ENERGY - The ability to do work or to make things move.

EQUILIBRIUM PRICE - That price at which the quantity of a good or service supplied by producers is exactly equal to the quantity demanded by consumers. (Also called market clearing price)

EQUITY - Fairness. In taxation, equal treatment of people with the same incomes and circumstances.

EXPORTS - Goods and services sold to foreign people, businesses, or governments.

FISSION - The splitting of the nucleus (or center) of one atom into two or more smaller atoms; fission often releases large quantities of energy.

FISSION PRODUCTS - The smaller atoms formed when atoms fission or split.

FLY ASH - Tiny particles of solid ash in the smoke when fuels such as coal are burned.

FOSSIL FUELS - Coals, petroleum and natural gas; this term applies to any fuels formed from the fossils of plants and animals that lived eons ago.

FUEL - Anything that can be burned or fissioned to produce heat energy.

FUEL CELL - A device similar to a battery in which fuels such as hydrogen gas or methane can be directly combined with oxygen to produce electricity and very little heat; the principal byproducts of the process are water or carbon dioxide.

FUSION - The process of combining the nuclei or centers of two light atoms to form a heavier atom; fusion can release great quantities of energy. The sun produces its energy by fusion.

GAS COOLED REACTOR - A nuclear reactor that is cooled by a gas like air or helium, rather than by water or other liquid.

GASEOUS DIFFUSION - A process by which natural uranium is enriched and becomes a better nuclear fuel.

GEOTHERMAL ENERGY - Heat energy produced deep within the earth through hot rocks deep beneath the earth's surface.

GEOTHERMAL STEAM - Steam formed by underground water seeping through hot rocks deep beneath the earth's surface.

GOODS - Tangible products like cars, clothing, and food that can be used to satisfy human wants.

HORSEPOWER - A unit that measures the rate at which energy is produced or used. A man doing heavy manual labor produces energy at a rate of about .08 horsepower.

HUMAN RESOURCES - The contributions made by people to the production of goods and services. Mental efforts as well as physical efforts are included.

IMPORTS - Goods and services brought into a nation from other nations.

INCOME - Payments to people who supply productive resources and transfer payments. Payment may be made in money, goods, or services.

INPUT - Factor used in production. Land, labor, and capital are the most commonly used input classifications.

INTERDEPENDENCE - In a market economy, all prices are to some degree affected by all other prices. Specialization makes trade necessary and people depend on others for vital goods and services.

KILOWATT - A unit that measures the rate at which energy is produced or used. Ten 100-watt lightbulbs use energy at the rate of one kilowatt (equal to 1000 watts). A rate of one kilowatt maintained for one hour produces or uses one kilowatt-hour of energy (equal to 1000 watt-hours).

MAGNETOHYDRODYNAMICS (MHD) - Process that uses a magnetic field to produce electricity directly from the hot smoke and gases we get from burning fuels like coal and oil.

MARKET CLEARING PRICE - See equilibrium price.

MARKET ECONOMY - An economy where the basic economic questions of what, how, how much, and for whom are answered in competitive markets. Resources, goods, and services are allocated by the forces of supply and demand, which determine market prices.

MEGAWATT - Unit to measure the rate at which energy is produced or used; it is equal to 1000 kilowatts (see kilowatt).

MODERATOR - Material, such as water and graphite, used in a nuclear reactor to slow the speed of neutrons produced when atoms split.

MONEY - Anything that is generally acceptable in payment of accounts. Money in the United States consists of currency and demand deposits. (See also currency and demand deposits.)

MONOPOLY - A market situation with only one seller and no close substitutes for the product.

NATURAL GAS - Gaseous fuels formed from the fossils of ancient plants and animals; often found with crude oil.

NATURAL RESOURCES - Factors of production not created by human effort. Land, water, and ores are examples.

NATURAL URANIUM - Uranium as it is found in the ground; a mixture of two types of uranium atoms.

NEUTRON - A tiny particle, extremely heavy for its size, often found in the nucleus of an atom. Neutrons have no electrical charge, and are released when atoms split (fission).

NUCLEAR POWER - The energy produced by splitting atoms (such as uranium) in a nuclear reactor.

OIL SHALE - Rock formed by silt and mud settling to the bottom of ancient seas that contains a substance similar to crude oil. So-called shale oil can be removed from the rock by heating and then used to make gasoline, kerosene, etc.

OPPORTUNITY COST - What is given up by producing a good or service. It is also called alernative cost because resources used one way could have been put to alternative uses. Those uses are the opportunity cost of the choice that was made.

OUTPUT - The goods and services that result from using inputs in the production process.

PER CAPITA - Literally, per head. Whenever it is important to know what is available for each person in a society, per capita measures are used.

PERSONAL INCOME - The sum of wages and salaries, rent, interest, dividends, income of unincorporated enterprises, and transfer payments.

PETROCHEMICALS - Chemicals removed from crude oil at the refinery and used to make a wide range of products such as plastics, synthetic fibers, detergents, and drugs.

PETROLEUM - See crude oil.

PHOTOSYNTHESIS - The process by which green plants convert sunshine into chemicals.

PLUTONIUM - A heavy, man-made, radioactive metal that can be used for fuel in a nuclear reactor.

POLLUTION - Damage done to air, water, soil, and other natural resources.

PRICE CONTROLS - Temporary measures taken by government during periods of rapid inflation. During World War II, for example, the U.S. government set maximum prices on many goods and services.

PRICE INDEX - An indicator of the general level of prices. The three most important price indices in the United States are the Consumer Price Index, the Wholesale Price Index, and the GNP Deflator.

PRODUCER - One who creates goods or services out of productive resources.

PRODUCTIVE RESOURCES - Human physical and mental labor, raw materials, and capital. They are also known as factors of production.

PRODUCTIVITY - A measure of worker efficiency. Output per unit of input is the general measure used.

PROFIT - The difference between a firm's revenue and its costs. Economists include the opportunity costs of the business owner's labor and capital or normal profit as costs. Profit then is revenue over and above normal profit.

PUBLIC GOODS - Goods that cannot be kept from one person without being kept from all. National defense and flood control are examples of public goods. Since no private citizen could force others to pay for such goods, they would not be provided privately. Only the government can provide public goods because it can tax people to pay for them. Not all goods and services provided by government are public goods, because many of them could be provided privately.

RADIOACTIVITY - A spontaneous change in the nucleus or center of an atom, accompanied by the release of energy called nuclear radiation.

RATIONING - Allocating available resources, goods and services among possible uses and users. Market prices are one way of rationing. Government has intervened and used a system of ration coupons when the price system was seen as unfair.

REGULATION - Government control of the operation of privately owned businesses. Regulation may limit entry into an industry by requiring licenses, may set maximum prices for business like public utilities, or may control the operation of business as with safety requirements.

SCARCITY - The basic economic problem. Human wants are greater than the resources necessary to satisfy those wants.

SERVICES - Economic actions that satisfy human wants. The work of doctors, plumbers, and actors are services.

SHORTAGE - When the price of a good or service is set below the market clearing price, a shortage results. At the low price sellers will bring less to the market than buyers are willing to buy. The unavailable quantity is the shortage.

SOLAR ENERGY - The energy received from the sun. Nuclear and geothermal energy are the only presently available energy forms not derived from the sun.

SOLAR POWER - Electricity, heat, or other useful energy produced from sunshine.

SPECIALIZATION - When people, businesses, or nations produce those goods and services they are most efficient at producing, then trading their surpluses for the other goods and services they need.

STEAM ELECTRIC PLANT - An electric power plant (either nuclear or one that burns coal or other fuel) in which heat boils water into steam, the steam is used to turn a turbine, and the turbine turns a generator to produce electricity.

STRIP MINING - Mining for coal or useful ores by removing the soil and rock found above them, rather than by tunneling underground.

SUBSTITUTES - Goods and services that can be interchanged. When a price increase in one good causes an increase in demand for another good, the goods are substitutes.

SUPPLY - The relationship between market prices and what will be offered for sale at those prices. The amounts of a good or service that sellers are willing and able to offer for sale at each possible price at a given time.

SUPPLY CURVE - The supply for a good or service shown graphically with price on the vertical axis and quantity supplied on the horizontal axis.

SUPPLY SCHEDULE - A table showing the number of units of a good or service that would be supplied at various prices.

SURFACE MINING - A synonym for strip mining.

SURPLUS - When the price of a good or service is set above the market clearing price, a surplus results. At the high price sellers will bring more to market than buyers will be willing to buy. The unsold quantity is the surplus.

TECHNOLOGY - The combination of skills and knowledge used to produce a good or service.

THERMAL POLLUTION - Harmful effects to the environment that may be produced by the warm water released by electric power plants into nearby lakes, rivers, or oceans.

THERMONUCLEAR FUSION - See fusion.

TRADEOFF - What must be given up when an economic decision is made. (See opportunity cost.)

UTILITY - A measure of usefulness to a consumer. Much of economic theory relies on consumers' ability to rank their choices in order of their preference.

WASTES, RADIOACTIVE - A by-product of producing power by splitting atoms in a nuclear power plant; some of these materials are highly radioactive and stay radioactive for a long period of time.

WATT - See kilowatt.

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